

# **Oral Health Literacy of Parents of Preschoolers**

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## **Abstract**

**Aim:** The aim of this project was to find the level of oral health literacy of parents of pre-school age children regarding their child's oral health. The primary objective was to improve the oral health status of preschoolers and to prevent early childhood caries.

**Methods:** 117 participants (parents of preschoolers) completed a self-administered oral health literacy questionnaire. Data obtained from the study was analysed using a statistical package (SPSS). Firstly, descriptive analysis was undertaken generating tables and graphs of socio-demographic variables. Later, associations between oral health literacy and socio-demographic variables were identified and also relation between parents' oral health literacy and their attitude towards water fluoridation in Christchurch was identified using bivariate and multivariate analysis. Psychometric analysis was generated to test validity and reliability of the oral health literacy questionnaire.

**Results:** In the total sample, 38% of participants had poor oral health literacy regarding their child's oral health. The results also indicated that there were associations present between parents' oral health literacy and socio-demographic variables such as ethnicity, education and family income. Nearly half of the parents opted for water fluoridation in Christchurch. A strong association between parents' oral health literacy and their attitude towards water fluoridation was identified. In the total sample, 40% of parents were not aware of need for first dental visit before the school age. Reliability was good for the developed oral health literacy instrument.

**Conclusions:** This study of parents' oral health literacy in Christchurch, New Zealand identified association of oral health literacy and socio-demographic variables which gives future guidance to improving oral health status of New Zealand children. The relation

between parents' oral health literacy and their attitude towards water fluoridation was shown in this study. This result might be used in future water fluoridation surveys. Future studies are needed to examine health care provider's perspective in improving parents' oral health literacy and to tailor more effective public health interventions to improve parents' oral health literacy.

## **Glossary of terms**

### **Avulsion**

A tooth that has been forcibly and traumatically displaced from its normal position, usually completely forced from its alveolar socket. In some cases, if attended to early, it can be surgically re-implanted. (Elsevier, 2009)

### **Communicable diseases**

An illness due to a specific infections agent or its toxic products capable of being directly or indirectly transmitted from (man to man, animal to animal, or from the environment through air, dust, soil, water, food etc.) to men to animal(Peter, 2000, p.912).

### **Comprehension skill**

Comprehension skills are the ability to use context and prior knowledge to aid reading and to make sense of what one reads and hears.

### **Construct validity**

Construct validity refers to whether a scale measures or correlates with the theorized psychological scientific construct (e.g., "fluid intelligence") that it purports to measure (Construct validity, Wikipedia).

### **Convenient Sampling**

Convenience sampling (sometimes known as grab or opportunity sampling) is a type of non probability sampling which involves the sample being drawn from that part of the population which is close to hand (Convenient sampling, Wikipedia).

**Convergent Validity**

Convergent validity, is the degree to which an operation is similar to (converges on) other operations that it theoretically should also be similar to (convergent validity, Wikipedia).

**Cross-sectional study**

Cross-sectional studies (also known as Cross-sectional analysis) form a class of research methods that involve observation of all of a population, or a representative subset, at a defined time (Cross-sectional study, Wikipedia).

**Decision making**

Decision making is the act of reaching a conclusion which generally follows a logical thought process. Shared decision making is the process of interaction with patients who wish to be involved with their health care providers in making health care decisions (Thomas, 1997)

**Dental Caries**

Dental caries is an infectious microbiological disease of the teeth that results in localized dissolution and destructions of the calcified tissues (Sturtevant et al, 2003, p.62)

**Dental Sealant**

Dental sealants are a dental treatment consisting of applying a plastic material to one or more teeth, for the intended purpose of preventing dental caries (cavities) or other forms of tooth decay (Dental Sealant, Wikipedia).

### **Discriminant validity**

Discriminant validity describes the degree to which the operationalization is not similar to (diverges from) other operationalizations that it theoretically should not be similar to (Discriminant validity, Wikipedia).

### **General health literacy**

The tertiary education commission defines literacy as “the written and oral languages people use in their everyday life and work; it includes reading, writing, speaking and listening” (Priston and Searle, 2010)

### **Health care Maintenance**

Health care maintenance is defined as seeking and forming a partnership with providers. Examples include reading and filling out a health history form, following dosage instruction on medicine label, and adhering to follow-up instructions (Rudd, 2005).

### **Health Education**

WHO defines health education as “Health education as a general education, is concerned with changes in knowledge, feelings and behaviour of people. Health education concentrates on developing such health practices as are believed to bring about the best possible state of well being” (Peter, 2000, p.573).

### **Health literacy**

Health literacy is defined as “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions (Priston & Searle, 2010, p.1).

### **Health promotion**

Health promotion is defined as enhancing and maintaining health. The examples include using information from a food label to interpret nutritional information to decide what products to purchase (Rudd, 2005).

### **Health Protection**

Health protection is defined as the safeguarding individuals and the communities. Examples include using a booklet about periodontal disease prevention, interpreting a posting about oral cancer screening tests, or understanding a letter and chart communicating test results (Rudd, 2005).

### **Internal Consistency**

In statistics and research, internal consistency is typically a measure based on the correlations between different items on the same test (or the same subscale on a larger test). It measures whether several items that propose to measure the same general construct produce similar scores.

### **Maori**

The Māori (pronounced **Māori**: [ma : ɔ.ɾi] or commonly IPA: [mauri] by English speakers) are the indigenous Polynesian people of New Zealand (Aotearoa). They arrived



from East Polynesia in several waves at some time before the year 1300, settled and developed a distinct culture. Their language is very closely related to Cook Islands Māori and Tahitian.

### **Oral Health literacy**

Oral health literacy is defined as “degree to which individuals have the capacity to obtain process and understand basic oral health information and services needed to make appropriate health decisions, a definition consistent with that of general health literacy.” (Sabbahi et al, 2009, p.452)

### **Patient- centred care**

Patient-centered care defined as, remaining clearly focused on the well-being of individual patients (Stewart 2001).

### **Plunket nurses**

A Plunket Nurse is a Registered Nurse who has completed or is completing further specialty training in the area of Well-Child health/community child and family/whānau health promotion. The focus is on delivering a primary health care service based on the Tamariki Ora Schedule (health promotion, education, clinical assessment and whānau/family support) to child clients aged birth to approximately 5 years, and their whānau/families/caregivers.

### **Prevalence**

Prevalence is defined as the total number of cases of a particular disease in a given population at a specific time (The American heritage medical dictionary, 2007).

## **Sample**

It is the representative part of a whole group of people or population to be studied (Peter, 2000, p.930).

## **Stratified sampling**

Where the population embraces a number of distinct categories, the frame can be organized by these categories into separate "strata." Each stratum is then sampled as an independent sub-population, out of which individual elements can be randomly selected.

## **Systems Navigation**

System navigation is defined as gaining access to needed services and understanding the rights. Examples include understanding a statement of rights and responsibilities, offering informed consent and accessing Government's services (Rudd, 2005).

## **Teething**

Teething is the process by which an infant's teeth sequentially appear by breaking through the gums. Teething may start as early as three months or as late, in some cases, as twelve months. The typical time frame for new teeth to appear is somewhere between six and nine months. (Teething, Wikipedia)

## **Malocclusion**

Malocclusion is defined as any deviation from normal occlusion of teeth. The teeth are in abnormal position to the basal bone of the alveolar process or to the adjacent teeth and/or opposing teeth (Rani, 2002, p.12)

**Tooth Eruption**

Tooth eruption is a process in tooth development in which the teeth enter the mouth and become visible (Tooth Eruption, Wikipedia).

**Water Fluoridation**

Water Fluoridation is defined as “an upward adjustment of fluoride ion concentration in a public drinking water supply so that the level of fluoride is maintained at the normal physiological level of 1ppm to prevent dental caries with minimum possibility of causing dental fluorosis (Peter, 2000, p.931).

## Chapter One: Introduction

*“A two year old girl is diagnosed with an inner ear infection and prescribed an antibiotic. Her mother understands that the medication should be taken twice a day. After carefully studying the label on the bottle and deciding that it doesn’t tell how to take the medicine, she fills a teaspoon and pours the antibiotic into her daughter’s painful ear” ( Bohlman & Panze, 2004)*

Health literacy is an excellent antidote to these confusions in health care. Health literacy is a non-pharmacological method of managing and preventing diseases. Basic health knowledge is needed in order to have a healthy life. Overwhelming developments in information technology and rapid advances in medical scientific knowledge demand that the public get an ever-increasing understanding of diseases for good decision-making and for self-management of diseases. Naidu (2008) indicates health literacy as the “cornerstone of many other life skills”. Some key features of low health literacy include, Low health literacy will interfere with the ability to process and understand information about health (Priston & Searle, 2010); Low health literacy is associated with a range of poor health outcomes (Nutbeam, 2008); and data from many developed countries show a relationship between low health literacy levels and improper use of available health services (Nutbeam, 2008). In 1974, the term health literacy was first used in a discussion of health education as a policy issue affecting the health system (Nutbeam, 2008). The problems associated with health literacy have been recognised for at least 25 years (Eagle, Reid, Hawkins, & Styles, 2005). The WHO commission on the social determinants of health, identified health literacy as having a central role in determining inequalities in health in both rich and poor countries.

## **1. What is Health literacy?**

There are various definitions for health literacy in the literature. The widely accepted definition is “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions” ( Eagle, Reid, Hawkins & Styles, 2005, p.30; Priston & Searle, 2010, p.1).

Nutbeam(2004, p.2072) defines functional health literacy as “being able to apply literacy skills to health related materials such as prescriptions, appointment cards, medicine labels and directions for home health care”.

Kickbusch, et al. (2008) identified five important key dimensions for health literacy. Those are

1. health care system knowledge and utilization;
2. basic health knowledge;
3. market and consumer behaviour;
4. health competencies at the workplace and
5. Political participation. (Kickbusch, Maag, & Kris, 2008).

The Australian Bureau of Statistics (2006) has given a promising definition to health literacy as “The knowledge and skills required to understand and use information relating to health issues such as drugs and alcohol, disease prevention and treatment, safety and accident prevention, first aid and emergencies and staying healthy”.

After reviewing above definitions health literacy is not only reading and understanding health related materials but also having basic health knowledge to prevent diseases, self-manage chronic conditions and to participate in health care decision making.

None of the above definitions indicated the “interest” in seeking health care information as an important factor to achieve health literacy. According to social Psychologist, there are different stages (see Figure 1) through which an individual passes when adopting new ideas and practices (Peter, 2000). In those stages, interest plays an important role (Peter, 2000). In the present scenario, both government and media have been publishing and spreading a lot of health information without reaching its public. This is because of the lack of interest towards health information persisting among the general public. Hence, without an individual’s attention, it is difficult to provide any information that is received by the target audience.

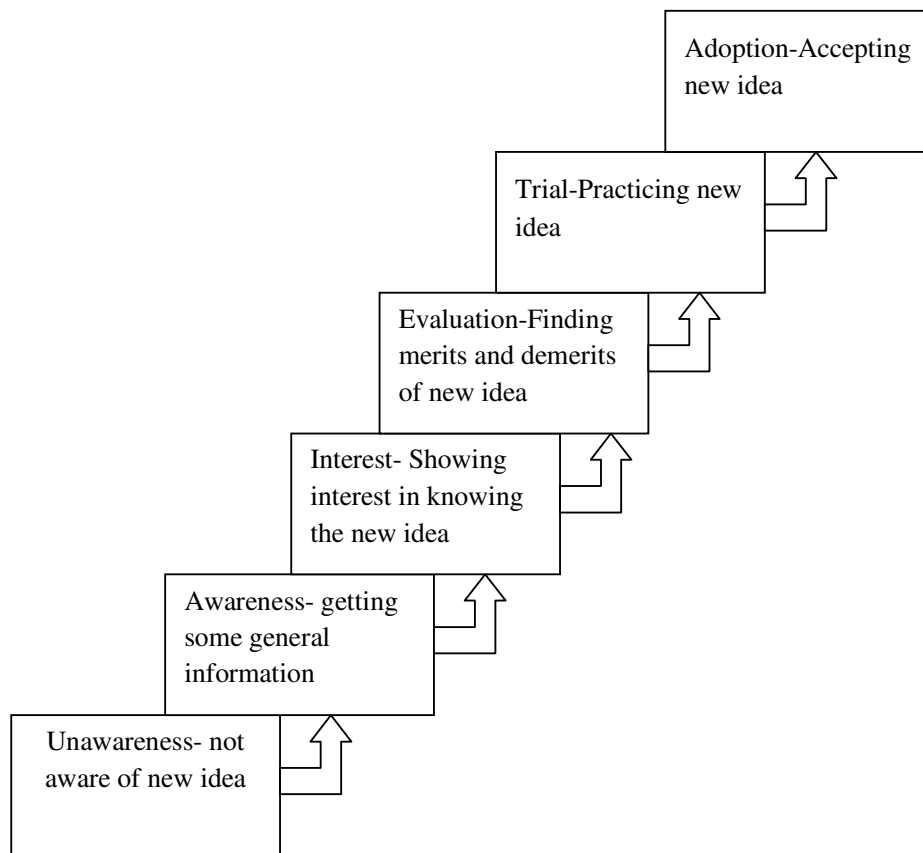


Figure 1 *Step pattern of stages in the adoption of new ideas*  
(Peter, 2000, P.579)

This pattern applies to health literacy as the provision of health information and education is needed for an individual to improve health literacy. There are three distinct levels in health literacy, which are the functional, interactive and critical.

“Functional: basic skills in reading and writing necessary for effective functioning in a health context;

Interactive: More advanced cognitive literacy and social skills that enable active participation in health care; and

Critical: the ability to critically analyze and use information to participate in actions that overcome structural barriers to health.” (Coulter et al, 2008, p.2)

The health literacy is a distinct concept, rather than a derivative concept from literacy and numeracy skills. Health literacy is considered to be obtained and processed in the following way; See Figure 2 below.

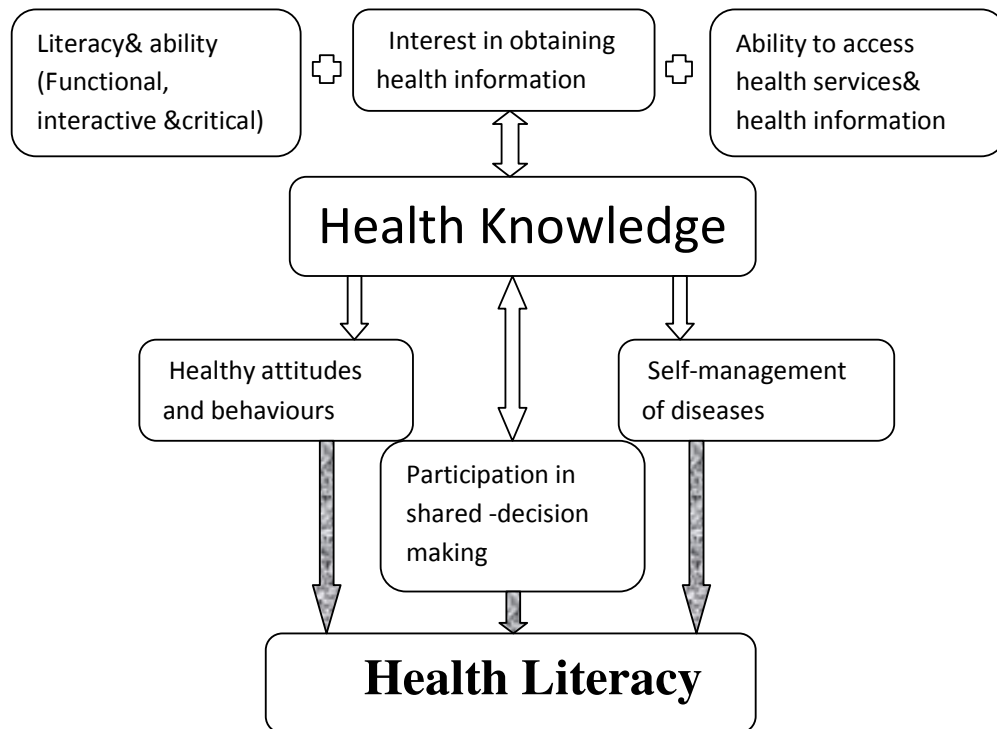


Figure 2

*Flow chart that describes the process in health literacy*

**Figure two illustrates:**

- A person with general literacy, ability to understand health information; and ability to access health information is expected to have high level of health knowledge.
- Basic health knowledge will possibly increase the interest in receiving health information. At the same time, interest in getting health information is expected to increase the health literacy.



- Health knowledge will help an individual to participate in shared-decision making in health care. By participating in shared-decision making, the existing level of health knowledge is expected to be increased with the help of health care providers.

Thereby, a person with high level of health literacy will have healthy behaviours and attitudes and also they will self-manage diseases and participate well in shared- decision making.

## **2. The Role of Health literacy in Self Management**

Patients have been viewed as principal “primary health care workers” who deal with most of their own illness most of the time (Stacey, 1992). Due to cost and increased medical waiting times in speciality care, patients feel forced into a situation of self care. A shift from acute to chronic ill-health automatically involves patients in their own health care. (William, 1994) Patients with chronic diseases necessarily resort to self-management, day-to-day management of long term and chronic illnesses such as asthma, diabetes and arthritis (Cosion, Ultzer, Parksons & Askham, 2008). Encouraging patients towards self-management can improve their health knowledge and helps them to adapt to their treatment recommendation (Coulter, Parsons & Askham, 2008). Self-management initiatives appear to work better when integrated into the normal health care system, such as involving patients in clinical decision making with informed choices and improving their knowledge about disease conditions may enable them to practice better self-management.

## **3. The Role of Health Literacy in Shared Decision Making**

Decision making is the act of reaching a conclusion which generally follows logical thought processes. Shared decision making is the process of interaction with patients who wish to be

involved with their health care providers in making health care decisions (Thomas, 1997). There is evidence that the expanding involvement of patients in care produces better health outcomes (Kravitz & Melnikow, 2001). Various factors affect patients' participation in decision-making with clinicians in their healthcare. Patient-related factors, such as acceptance of the new patient role, lack of medical knowledge, lack of confidence, and various other socio-demographic parameters affect willingness to participate in the process of medical care. (Longtin et al, 2000). All these patient related factors are improved by health literacy. Patients should understand what is known, as well as what is not known, about the outcomes that are important to them. Patients should be able to choose options based on information and according to their own treatment preferences.

A theory-based literature review study including an analysis of intended and unintended impact of choice-related policies in health care in UK, and USA, revealed that patients participate much less in the decisions about their own treatment than they would wish (Fotaki et al., 2008). There are numerous barriers identified to patient centred care such as design of health care systems, poor communication skills, attitudes of doctors, inadequate training of health professionals, limited resources, lack of information in an accessible format, failure to involve family and friends, lack of integrated care, lack of patients rights, lack of understanding medicine as an "inexact science" and lack of awareness of treatment alternatives coupled with inexperience and discomfort in engaging with clinicians and the list goes on (Robb & Seddon, 2006). Another good reason for patients not engaging in decision making is the increased trust in physicians or care providers. This is due to lack of health literacy which makes patients with low health literacy needing to completely depend on health care provider's decision, in which patient's preferences can be completely or partially ignored. These kinds of health decisions can result in poor health outcomes.

Hence, patients with a high level of health literacy will have abilities such as explaining their symptoms and chief complaint to the doctor, monitoring the medications, researching and gathering information about diseases, asking for clarification about the treatment options, continuing the follow-up visits, making informed decisions about their health and treatment plans, self- managing the chronic diseases, and preventing communicable and other diseases.

#### **4. Impacts of low Health Literacy**

Gingerich (2007, p.18) lists several factors as impacts of low health literacy level in the community. Those are difficulty in navigating the health care system; difficulty in understanding and completing documents and consent form; and inability to read directions for prescriptions. He also includes, use of more expensive services; misuse of medications; misunderstanding of self care instructions and practice of less preventive health care (Gingerich, 2007). Other factors that can be added to this list are depression due to misunderstanding of one's disease conditions; increased use of speciality care; increased need for health care work force; and poor response in health care research and surveys.

Poor health literacy is considered as a contributor of poor health status in an individual, poor health outcome in a community and health inequalities. The overall major consequence is the cost as the patients with relatively low health literacy use more health care resources than those with higher literacy abilities (Eagle, et al., 2005). Health care costs due to low health literacy in the USA are estimated at \$US 73 billion and at 77.5 billion pounds in the European Union (Kemp & Eagle, 2008). Another study estimated the cost for an individual due to lack of health literacy as US\$143-7,798 (Eicher, Wieser, & Brugger, 2009). In New Zealand Maori have low health literacy compared to non-Maori (Ministry of Health, 2010d) and the 2003

health survey indicates Maori have highest number of visits to GP compared to non Maori (McNeice, 2003).

Some of the reasons for increased health care costs due to a lack of health literacy in the community are:

- People with a low level of health literacy are less likely to seek treatment from primary care providers which leads into hospital admission and to specialist consultations (Ministry of health, 2010d).
- Due to an inadequate awareness about diseases, patients with a low level of health literacy will seek treatment in the final stage of the diseases such as cancer and diabetes. This might increase the treatment cost (Ministry of health, 2010d) due to more complicated and expensive intervention requirements at the stage of the diseases.
- They are less likely to use preventive services such as vaccination and screening (Kemp & Eagle, 2008).
- They are more likely to use emergency services (Ministry of health, 2010d).

Baker et al (2007) established a health literacy and mortality rate in USA. The crude mortality rate for individual with inadequate, marginal and adequate health literacy were 39.4%, 28.7% and 18.9% respectively. The table 1 illustrates few examples for serious illness due to low level of health literacy in USA.

Table 1

*Effect of lack of Health Literacy (Kemp & Eagle, 2008, p. 119)*

Disease	Effect of lack of health literacy
Alcohol use during pregnancy	Estimated 5000 infants born with foetal alcohol syndrome each year.
Diabetes	About 1/3 of the nearly 16 million people with diabetes are not aware they have the disease.
Skin Cancer	Approximately 70% of American adults do not protect themselves from sun's dangerous rays.
Breast cancer	More than 20% of females aged 50 and over have not had mammograms in the last 2 years.
Prostate cancer	Only about half of prostate cancers are found early

## 5. Measurement of Health literacy

Health literacy is measurable in the same way as assessing education obtained in the school. The measure of health literacy will be best achieved where content and context are well defined (Nutbeam, 2009). Even if the concept remains constant, different measurement tools will be required for different ages and stages in life (Nutbeam, 2008). There are different standard measuring tool available to measure general health literacy such as TOFHLA and REALM (Parker et al. 1995; Davis et al.1993; Baker, 2006). These tools are useful for screening measurement in clinical settings but not for comprehensive measures of health literacy (Nutbeam, 2009). The recent comprehensive health literacy instruments such as HALS measures five domains namely health promotion, health protection, disease prevention, health care maintenance and service navigation (Ministry of Health, 2009; Rudd, 2007).

## **6. Health literacy in New Zealand**

The general literacy level of New Zealand is 99% and most of the developed countries have the same level as New Zealand (UNISEF, 2008). The average reading skill level of the adult population is often overrated. The reading skill level is generally 3-5 grades below the level expected from the final year of formal education (Eagle et al 2005). The average reading skill of American adults is reported as 8<sup>th</sup> grade, that is pre-high school (Ministry of Education, 2004). According to the International Adult Literacy Survey, this level is similar across most developed countries (Ministry of Education, 2004). The pre-high school level is not enough to understand the basic health care procedures and prevention of diseases without some kind of intervention to assist understanding of information.

There is only one time series data source, relating education and health that is available in New Zealand, and it is about association between education with mortality rate, which shows strong association between a higher level of education and improved health (Ministry of Education, 2009). The New Zealand health strategy recognises the role of health literacy in the health of individual and in the community (Naidu, 2008). New Zealand adults have low health literacy which acts as a barrier to understanding written and oral health care information and instructions (Naidu, 2008).

According to the results from the 2006 Adult literacy and life skills survey, New Zealanders on average have poor health literacy skills, with both Maori and Non Maori males and females scoring an average of less than 275, which is the minimum required score for individuals to meet the complex demand of everyday life and work in an knowledge- based economy (Ministry of Health, 2010d).

Non-Maori males and females have significantly higher health literacy skills than Maori, and Maori females have higher health literacy skills than Maori males (Ministry of Health, 2010d). Fifty percent of employed non-Maori and 75 percent of employed Maori have poor health literacy (Ministry of Health, 2010d). Maori and Non- Maori with a tertiary education are more likely to have good health literacy skills compared to those with lower levels of education, which is similar to other international evidence (Ministry of Health, 2010d). Detailed analysis of the 2006 adult literacy and life skill survey denotes that Maori and non-Maori with tertiary education participation and non-Maori with household income of \$100,000.00 plus have health literacy scores of above 275, which is the adequate capacity to cope with the demands of everyday life in an advanced society (Ministry of Health, 2010d).

## **7. Statement of problem**

The concept of health literacy applies to all aspects of health, including oral health. Early childhood caries is a new phenomenon that has emerged as a significant health issue for children younger than 5 years old (Peterson-Sweeney & Stevens, 2010). The American Academy of Paediatric dentistry has defined the early child hood caries as “ the presence of one or more decayed missing or filled tooth surfaces in any primary tooth in a child 71 months of age or younger” (Peterson-Sweeney & Stevens, 2010). In the United States 40% of children have early childhood caries by the time they reach kindergartens (3 years of age) (Weiss, et al., 2003). The children who have early childhood caries are much more likely to develop further dental problems, including gingivitis and periodontal disease as they age (Heller, Eklund, Pittman, & Ismail, 2000). Children with cavities have more oral infections and pain, resulting in issues with eating and nutrition (Silk, 2010). According to a United States health report, 51 million school hours are missed annually as a result of oral health related illness (Silk, 2010).

In spite of having the opportunity for community water fluoridation and fluoride dental sealant for preventing caries, the incidence of dental caries has been identified as the major prevalent, unmet health need in children throughout the world (Peterson-Sweeney & Stevens, 2010). Dental caries or tooth decay is the most prevalent disease in children (Silk, 2010). The incidence of dental caries is 5 times more common than asthma and 7 times more common than hay fever. Parents need to understand that dental caries as a common, complex and chronic disease (Silk, 2010). Dental caries is considered a controllable disease much like diabetes and heart disease (Silk, 2010). Children who have risk factors such as low socio-economic status, low mother's education level and increased consumption of sugar rich foods are 32 times more likely to have early childhood caries (Weiss, et al., 2003).

Another significant problem not well known by the parents is that dental caries is a contagious disease which is spread from parents to children (Peterson-Sweeney & Stevens, 2010). The oral mucosa serves as the barrier to more than 500 bacterial strains (Peterson-Sweeney & Stevens, 2010). These bacteria will cause opportunistic infections in the body and easily spread through out the body and cause various infections in children (Peterson-Sweeney & Stevens, 2010). Proper oral hygiene practices started from birth will prevent early childhood caries and are therefore to be encouraged.

Parents with low health literacy are expected to have less knowledge about children's health and more likely to follow unhealthy behaviours and attitudes which possibly affect children's health. This argument has been supported by a systematic review study which was conducted by reviewing 4182 titles and abstract (DeWalt & Hink, 2009). The 24 articles which met inclusion criteria in this study supported the importance of parental health literacy in child's health outcomes (DeWalt & Hink, 2009). Children whose parents have low health literacy have poor health outcomes compared to children of parents who have high health literacy



(DeWalt & Hink, 2009). Evidences that were reviewed revealed the effect of interventions with good written materials and counselling in improving the health knowledge, the health attitudes and the behaviours (DeWalt & Hink, 2009).

A study revealed that, parents with low literacy had less asthma- related knowledge, and their children were more likely to have moderate to severe persistent asthma (DeWalt, Dilling, Rosenthal, & Pignone, 2007). A study was conducted to assess the parental health literacy and numeracy skills in understanding instructions for caring for young children (Kumar, et al., 2010). In that study, a total of 182 parents were recruited and 47% of parents could correctly describe how to mix infant formula from concentrate and only 69% could interpret the digital thermometer to determine whether an infant had a fever (Kumar, et al., 2010). An interesting finding in this study was that 99% of 182 parents had adequate literacy skills (Kumar, et al., 2010).

The development of the permanent first molar is initiated in the 4<sup>th</sup> month of intra uterine life (Baskar, 1990) and teeth need to last for the child's lifetime. Hence, preventing oral diseases should ideally begin before the birth of the child as it is the mother's responsibility to protect the child's teeth. The mother should know matters such as nutrition and interaction of certain drugs in the child's development. After the child is born, the mother should know the proper nursing care to prevent early childhood caries. Parents are expected to know the effects of sweet drinks, suboptimal diet and poor brushing habits in the child's oral health, as well as the importance of fluoride in preventing caries and proper usage of fluoride tooth paste. The parents are responsible for preventing decay and caring for children's oral health in the preadolescent period, especially the pre-school period; hence parents should have good knowledge about preventing dental caries and protecting the child's oral health system.

## 8. Purpose of study

New Zealand's Oral health care service is a mix of publicly and privately funded care. Publicly funded oral health care is divided into four groups; children from birth to year eight; adolescents from year nine to age 18; low-income adults and medically compromised patients (Ministry of Health, 2006). The Oral health programme has been implemented by the Department of Health since 1920, providing free oral health care to school children in regular intervals (Fulton, 1951). The Oral health care system in New Zealand is similar to that in Australia and the United Kingdom (Ministry of Health, 2006). But, the prevalence of dental caries in New Zealand is higher than Australia and United Kingdom (Ministry of Health, 2006).

According to the Ministry of Health data (2008) 49% of the country's 5 year- olds and 53% of 8 year olds in New Zealand have dental caries (See Figure-3). Oral health care has been provided free of charge for nearly 90 years for every child in New Zealand, and dental caries is currently considered by health experts as a “big issue” in New Zealand.

In Star ship's oral health campaign, child community service manager Kathy Peacock indicated that many parents do not realise the available free dental service to children (The Press, 2009). In the Canterbury region, 95% of utilization is seen in school dental services compared to 70% of utilization at 3 and 4 years of age (Ministry of Health, 2007). The use of dental services by pre-school children of age below 3 years is significantly low than is desirable (Ministry of Health, 2007). This indicates parents' unawareness about the services and less knowledge in preventing early childhood caries (Ministry of Health, 2007). Possible reasons for this might be ignorance and lack of oral health literacy among New Zealand parents.

Canterbury has the second largest population in New Zealand with a significant amount of indigenous and immigrant population (Statistics New Zealand, 2010; Wikipedia, Christchurch, 2006). Compared to all major metropolitan/urban areas in New Zealand, the Canterbury region is the least water fluoridated area (Ministry of Health, 2009). Christchurch is the only major city without water fluoridation in New Zealand (Canterbury District health Board, 2006). In water fluoridated areas of New Zealand, the decay rates were 30 percent lower among five year olds and 40 percent lower among 12 year olds (see Figure-3), (Ministry of Health, 2008). Christchurch four year-olds have on average 95 percent more decay in their baby teeth than children from Wellington of the same age (Lee & Dennison, 2004). Christchurch nine year olds have on average 80 percent more decay in their permanent teeth than Wellington nine year olds (Lee & Dennison, 2004). According to Ministry of Health report (2008), DMFT rate among five year olds of Maori and Pacific Islander decent living in non-fluoridated areas were very high compared to fluoridated areas (See Figure-3).

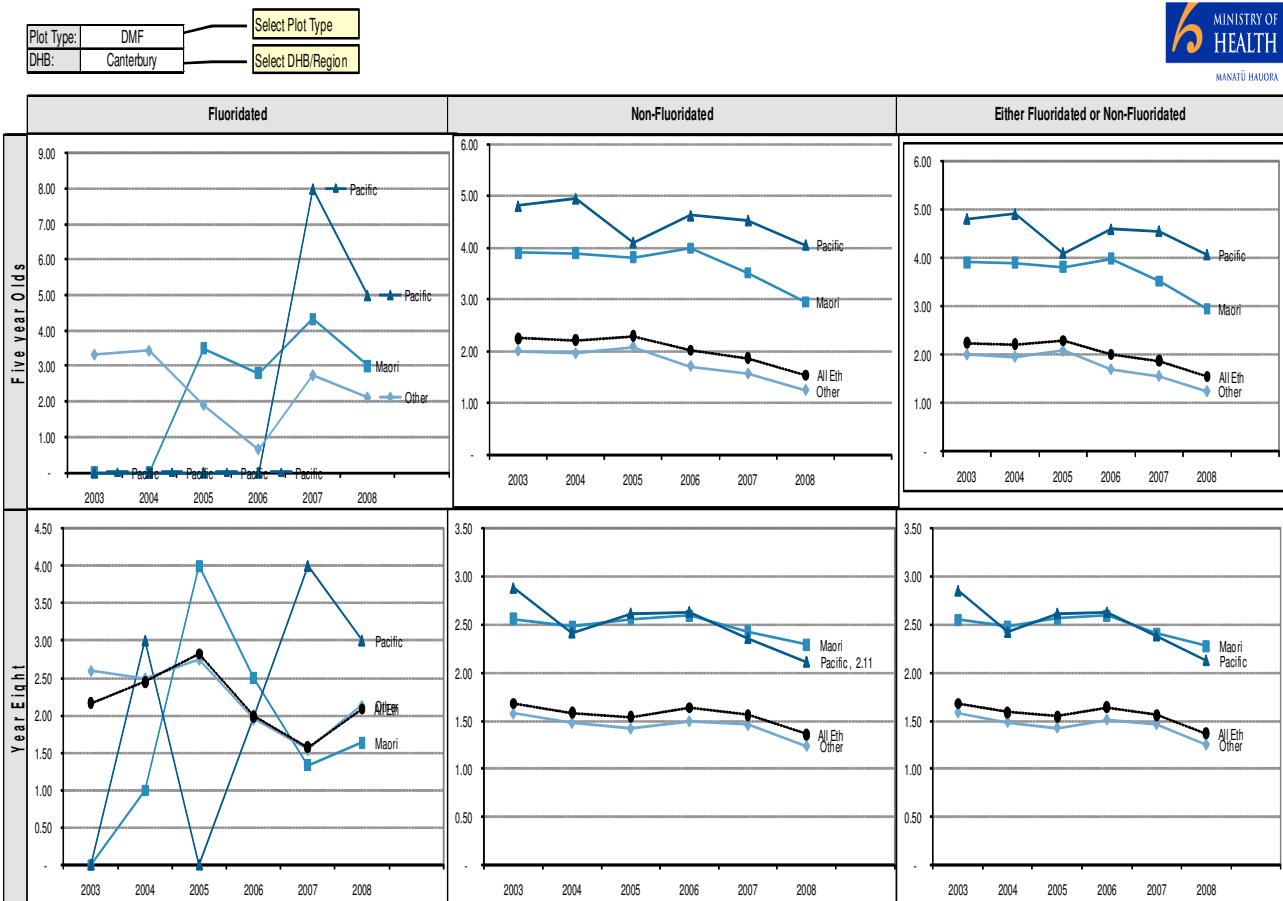


Figure 3

Age 5 and year 8 Oral health time series Data 1990-2008

(Source: Ministry of Health, 2008)

Hence, children living in the Christchurch area are more vulnerable to early childhood caries. Parents are expected to have high level of oral health knowledge to prevent dental caries. The level of oral health knowledge has not been determined so far. This research will help to determine the existing level of oral health knowledge among New Zealand parents. The current dental health services are providing good service by changing the decayed teeth to filled teeth (Ministry of Health, 2007). But, this does not change the overall oral health status (Ministry of Health, 2007). A current Government project is aimed at decreasing decayed, missing and filled teeth more than replacing decayed teeth to filled teeth (Ministry of Health, 2007). This might be achieved in part by improving the health literacy of parents. No data exists regarding oral health literacy among New Zealand parents, creating a gap in the research and knowledge base. The first step in increasing parent's health literacy will be determining the present level of health literacy among New Zealand parents.

## 9. Research Questions

This study investigates the following research questions

1. What is the level of oral health literacy among parents in Christchurch?
2. What is the level of oral health knowledge among parents in Christchurch?

With respect to the following:

Basic oral health knowledge

Knowledge in preventing early childhood caries

Knowledge about teething and managing pain due to teething

Knowledge on system navigation

3. What is the level of comprehension knowledge among parents in Christchurch?
4. What is the attitude of parents regarding water fluoridation in Christchurch?
5. What is the Association between health literacy and attitude towards fluoridating water in Christchurch?

## **Chapter Two: Literature Review**

Individuals belonging to the groups with low income and those with less education have fewer skills to obtain information about preventive services or available treatment options. These people should be identified by the health care providers and their health literacy level should be measured in order to help them understand information about health care (Richman, Lee, Rozier, & Gong, 2007). The awareness and importance of oral health literacy has grown and efforts have been directed at adopting the concept of health literacy to dental practice and research (Jones, 2007).

Oral health literacy instruments were developed on the basis of general health literacy instruments. There are six oral health literacy instruments which were developed between 2007 and 2010; they are the Rapid Estimate of Adult Literacy in Dentistry-30 (REALD-30), Rapid estimate of adult literacy in dentistry-99 (REALD-99), Test of Functional Health Literacy in Dentistry (TOFHLiD), Oral Health Literacy Instrument for Adults (OHLI), Rapid Estimate of Adult Literacy in Medicine-Dentistry (REALM-D) and Comprehensive Measure of Oral Health Knowledge Conceptual knowledge in the context of oral health literacy (CMOHK). These instruments have been validated and tested for the use by researchers and health care workers.

These instruments measure the oral health literacy of an adult. Expected Oral health knowledge of parents is different from the oral health literacy of an adult. Even though those instruments were not useful for measuring oral health literacy of parents, concepts and frameworks for measuring oral health literacy were obtained by reviewing these oral health literacy instruments.

The importance of oral health literacy for parents has been proved in various relevant researches. This study has reviewed the importance of parents' oral health knowledge, parents' education, parents' behaviour and attitude in deciding the oral health status of the children.

## **1. Measuring Oral Health Literacy**

In medicine, the most commonly used instruments to measure health literacy are the Rapid Estimate of Adult Literacy in medicine (REALM) and the Test of Functional Literacy in Adults (TOFHLA) (Lee, Rozier, Daniel-Lee, Bender, & Ruiz, 2007). REALM is a word recognition test and TOFHLA measures comprehension in addition to word recognition. The latest health literacy instrument is Health Literacy Adult survey (HLAS). It is based on five health literacy sub-domains: health promotion, health protection, disease prevention, health care and disease management and systems navigation (Gong, et al., 2007; Lee, et al., 2007; Sabbahi, Lawrence, Limeback, & Rootman, 2009; Taylor, et al., 2005).

The oral health instruments namely REALD-30, REALD-99 and REALD-M were all word recognising instruments and were developed using REALM as a template. TOFHLiD was developed by using TOFHLA as a template. Oral health literacy instruments such as OHLI and CMOHK measure oral health knowledge.

### **1.1 Rapid Estimate of Adult Literacy in Dentistry-30 (REALD-30)**

Until the development of REALD-30, no methods were available to measure the oral health literacy in dentistry. Hence little work has been done in health literacy in dental settings. Lee, et al. (2007) have developed a word recognition dental health literacy instrument (REALD-30) based on the design of REALM. The words in REALD-30 were taken from the *American*



*Dental Association Glossary of Common Dental Terminology*. In this instrument, commonly used terms and words were included by referring to the written materials and brochures usually provided to dental patients at the University of North Carolina at Chapel Hill Dental clinics, Orange Country Health Department, and North Carolina oral health section (Lee, et al., 2007). The words were listed in order of increasing difficulty. REALD-30 was designed to be read aloud by subjects to the interviewers. The interviewers were trained to score them accordingly (Lee, et al., 2007).

The developed REALD-30 instrument was tested on 202 participants recruited from the University hospitals. In addition to REALD-30, oral health status was also assessed using a self- perceived dental health status questionnaire using a Likert scale. Participants were asked to complete the Oral health impact profile consisting of 14 questions regarding the extent to which the oral health problems affect the subjects' overall quality of life. REALD-30 was designed to be read aloud by subjects to interviewers. The instrument was tested for its validity and reliability (Lee, et al., 2007).

The validity report of this questionnaire shows that REALD-30 was significantly and positively correlated to general health literacy instruments used in medicine. The correlations indicated that REALD-30 has a good convergent validity which was 0.86 for REALM and 0.64 for TOFHLA (Lee, et al., 2007). The result shows that health literacy was positively related to oral health related quality of life and in contrast, REALD-30 was not associated with self-perceived dental health status at a statistically significant level (Lee, et al., 2007).

As Lee, et al. (2007) indicated, one of the limitations of REALD-30 was the lack of a comprehension test. The instrument was tested using a convenient sample of study subjects who were recruited from health clinics and were higher users of health care (Lee, et al., 2007).

The same group of researchers who developed and tested REALD-30 have tested the same instrument in private practice. Jones, et al. (2007) conducted a cross-sectional study to measure oral health literacy among adult patients seeking dental care in a private practice setting in the USA. The main objective of this study was to examine the association of oral health knowledge, dental care visits and oral health status with oral health literacy in dental practices. Eligibility criteria to participate in this study were the ability to speak English and be aged between 18 and 80 years old. Oral health literacy was measured using REALD-30 (Jones, Lee, & Rozier, 2007).

The constructs for the study were selected and relied heavily on a framework suggested by Lee, et al (2007). Lee, et al. (2007) suggested that people with poor health literacy are likely to lack important health knowledge, have unhealthy behaviours and have poor compliance with routine medical visits. These factors may affect a person's ability to seek care without delay and they can also increase the use of emergency services resulting in poor health outcomes (Jones, et al., 2007).

Hence, this time researchers included a questionnaire consists of 23 questions, to measure components of Lee's health literacy framework. The questions covered the factors in a hypothesised causal pathway between literacy and its effect. The overall score of dental knowledge was scored as incorrect if answers to one or both of two multiple choice questions regarding dental caries prevention and periodontal disease were incorrect. Front office staff members in each dental clinic were trained to conduct the interviews (Jones, et al., 2007).

The analysis was conducted to predict the association of each of the predictor variables (knowledge, dental care visits and oral health status). The results suggest that a large number of patients have a low level of health literacy, which may interfere with their ability to process and understand basic health information. The results indicated that dental knowledge is a

strong predictor of low health literacy (Jones, et al., 2007). Hence, measuring dental health knowledge is a good measure of the level of health literacy of an individual (Jones, et al., 2007). This concept was used in the current study.

This instrument would be useful in clinical and public health settings to test the oral health literacy of a subject in the minimum amount of time. But there is a chance of response bias because reading questionnaire words will be easier for people whose first language is English. And also sometimes, due to embarrassment and anxiety, people find it difficult to read the words in the questionnaire in front of an interviewer or health care provider. And also REALD-30 would not be useful for people who have difficulty in speaking.

## **1.2 Rapid Estimate of Adult Literacy in Dentistry-99 (REALD-99)**

REALD-99 is a longer version of REALD-30 and it has been developed to increase the chance of accurately measuring dental literacy (Richman, et al., 2007). This instrument was tested by comparing dental health literacy word recognition and oral health outcome measures (Richman, et al., 2007). Oral health outcome measures the dental health status and oral health quality of life (Richman, et al., 2007). As for REALD-30, words included in REALD-99 were taken from *American Dental Association's Glossary of common dental terminology* and included by referring to brochures and written materials provided to the patients at the University of North Carolina at Chapel Hill School of dentistry (Richman, et al., 2007).

The words in the REALD-99 were ordered in increasing difficulty both in number of syllables and sound combinations (Richman, et al., 2007). The participants were instructed to read the words for which they believe they know the correct pronunciation. In REALD-30 such instructions were not given (Lee, et al., 2007). The participants in this study were parents or caregivers of paediatric dental patients. The exclusion criteria for the study participants were:

total illiteracy, inability to speak English and if the child patient was 15 years old or older. The instrument was tested for its validity and reliability. In this study the majority of parents were female, non-Hispanic, white and reported English as their first language. Because this study was conducted in a University setting, an average of 84% of participants read the dental terms correctly. REALD-99 tests the participants' ability to read given words and it does not determine if a patient really knows the meaning of that particular word. Richman, et al. (2007) indicated this as main limitation of REALD-99.

This instrument is useful to determine the oral health literacy level of a person who has the ability to speak and read good English. Hence, this instrument is not useful for people who can not read and speak English effectively. Even pronunciation might be different and difficult for immigrants from non-English speaking countries. If, however they were tested in their own language they might have high health literacy. It is difficult to measure the level of oral health literacy without measuring oral health knowledge, comprehension and numeracy. A person, who is able to pronounce the word "temperomandibular", for example, probably does not know what the temperomandibular joint is (Macek, et al., 2010). The word recognition instruments tests the ability to recognize, or read and pronounce individual words (Gong, et al., 2007).

REALD-30 and REALD-99 are considered as the first instruments developed in dentistry to test the level of oral health literacy (Richman, et al., 2007). The development of these instruments has opened the door for further research in oral health literacy instruments.

### **1.3 Test of Functional Health Literacy in Dentistry (TOFHLiD)**

The third oral health instrument, TOFHLiD was developed by using TOFHLA as a template. The main objective of this study was to develop an instrument to assess functional health literacy. It contains reading comprehension and numeracy sections. The reading comprehension section consists of three passages about follow-up instructions for caregivers, consent for dental treatment and description of Medicaid rights and responsibilities. The questions were designed by omitting the fifth, sixth or seventh word from the selected sentences of the passages. The numeracy section in the TOFHLiD has 12 questions related to instructions for fluoridated toothpaste; paediatric appointment card; and bottle prescription labels for fluoride drops; and for fluoride tablets.

TOFHLiD was tested for its validity and reliability. Construct validity was tested by administering three additional health literacy tests such as TOFHLA, REALM and REALD-99. Convergent validity was supported by large correlations between matching scales. Discriminant validity was supported when coefficients for convergent validity were larger than correlations among different scales using either the same or different measurement methods. Internal reliability was determined using Cronbach's alpha test.

TOFHLiD demonstrates good convergent validity. The predictive validity was partially established as TOFHLiD's scores were not significantly associated with self perceived oral health status of parents of paediatric dental patients and their children (Gong, et al., 2007; Sabbahi, et al., 2009). The internal consistency was not high. The validation report of this instrument does not recommend this questionnaire (TOFHLiD) for widespread use in clinical and public health practice.

#### **1.4 The Oral Health Literacy Instrument for Adults (OHLI)**

The oral health literacy instrument (OHLI) consists of two sections (i) reading comprehension and (ii) numeracy (Sabbahi, et al., 2009). The reading comprehension section is a 38-item test with words omitted from two passages about dental caries and periodontal diseases. The numeracy section consists of 19 items to test numeracy skills for taking dental prescriptions, post-extraction instructions and clinical appointment. An oral health knowledge test was developed with this instrument to test dental knowledge. This was used to predict the functional health literacy of the respondent. The knowledge test consists of seven pictures containing seventeen labelled items such as perioral and intra-oral structures, oral diseases and conditions, dental fillings, a dental prosthesis and different oral hygiene aids. Participants were asked to match the picture with correct items (Sabbahi, et al., 2009). For the knowledge test, each item was scored as 1= correct answer and 0= wrong answer. The total weighted score was from 0 to 100. The cut-off points for the three different levels for the oral health literacy scores were established based on Test of Functional Health Literacy for Adults (TOFHLA), which is inadequate (0-59), marginal (60-74), adequate (75-100).

Internal reliability was tested with Cronbach's alpha (0.898) test. Reliability was tested with intra class correlation coefficient ( $>0.6$ ,  $P < 0.001$ ) (Sabbahi, et al., 2009). Concurrent validity was tested by comparing OHLI score with education level and frequency of dental visits. Construct validities were tested by comparing OHLI scores with TOFHLA score using Spearman rho's correlation test. The two Construct validities are convergent and discriminant validity. The convergent validity was supported by strong positive correlation (0.613,  $P < 0.001$ ) between OHLI and TOFHLA scores. Discriminant validity was tested by assessing the association between OHLI and oral health knowledge test. There was a strong positive correlation (0.573,  $P < 0.001$ ) present between oral health knowledge scores and OHLI. The

correlation (0.381,  $P < 0.001$ ) between OHLI and TOFHLI was positive but not strong. The test result proves that the instrument to be a valid and reliable instrument, which can evaluate oral health literacy among adults (Sabbahi, et al., 2009).

An association between health literacy levels and patient's knowledge about different diseases was found (Sabbahi, et al., 2009). The majority of participants in this study had high functional health and oral health literacy (97% and 89%, respectively). Only 35% had adequate oral health knowledge (Sabbahi, et al., 2009). This difference might be due to the difficulty in answering the questions. The knowledge test was not pilot tested and was checked only for face validity and content validity by an expert panel. The questions included in the knowledge test were identification of anatomical structures like uvula and questions such as identification of composite filling. These questions would be difficult for a patient to answer as they require expert knowledge to get correct. This might be reason for low overall oral health knowledge score reported in the study. Hence, a Knowledge test should be designed on the basis of testing the knowledge of healthy behaviours and attitudes when using a community based sample.

### **1.5 Rapid Estimate of Adult Literacy in Medicine-Dentistry (REALM-D)**

A recent study was conducted in California, United States to evaluate dental and general health literacy in a community based sample. The instrument used in this survey was a combination of the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Rapid Estimate of Adult Literacy in Dentistry (REALD). The developed instrument was indicated as the rapid estimate of adult literacy in medicine and dentistry (REALM-D). The instrument consisted of three parts with words arranged in increasing difficulty (Atchison, Gironda, Messadi, & Martirosian, 2010).

A sample of 200 adult dental patients seeking treatment for the first time participated in the study. In the total sample, 154 participants (77%) read the list one correctly. One hundred forty five participants (72%) read list two correctly but only 38(19%) managed to read list three accurately. The final scores for non-white participants were significantly lower when compared to whites. REALM-D score increased where the level of education increased. In the regression analysis at the bivariate level, race, education and English remained predictive of health literacy. Atchison, et al., (2010) suggested that this instrument be used in clinical settings to identify the difference between people from different backgrounds and for people with English as a second language (Atchison, et al., 2010).

Participants who reported English as their first language had significantly higher scores than participants with English as a second language (Atchison, et al., 2010). This indicates that words in REALM-D are easier for English speaking people than non-English speaking people. More than health literacy, REALM-D measures the level of literacy in an individual (Atchison, et al., 2010). Using REALM-D it is difficult for non-English speaking participants to get high score for oral health literacy. The author has argued that ability to read and pronounce the medical terms is needed to communicate with a health care provider and REALM-D could be a useful for screening tool for low health literacy. This argument implies that a word recognition instrument also measures a patient's ability to participate in shared decision making (Atchison, et al., 2010). I argue that, an individual's ability to participate in shared decision making is measured by measuring participant's knowledge about oral health diseases; oral health behaviours and attitudes; knowledge about prevention; and management of diseases. Measuring the ability to read dental and medical terms would not be widely accepted as standard measure for shared-decision making.



Atchison, et al. (2010) indicated that REALM-D does not assess the individual's ability to understand the meaning of a medical or dental term, and they suggested, including comprehensive assessment in measuring health literacy in future studies (Atchison, et al., 2010). Hence, to test an individual's ability to understand and interpret the oral health care information, a comprehensive test should be included in the oral health literacy instrument. For this reason, a comprehension passage was included in our survey using this concept.

### **1.6 Comprehensive Measure of Oral Health Knowledge (CMOHK)**

This instrument (CMOHK) introduces a theoretical pathway linking health literacy with oral health decision making and outcomes (Macek, et al., 2010). This questionnaire consists of four topic areas; namely (i) basic knowledge of oral health; (ii) dental caries prevention and management; (iii) periodontal disease prevention and management; and (iv) oral cancer prevention and management. The questionnaire consists of a total of 41 questions (Macek, et al., 2010).

The instrument was developed by testing 41 open-ended questions. Final version of the conceptual oral health knowledge questionnaire was developed based on the results of the pilot test (Macek, et al., 2010). The final version of the instrument contained 20 basic oral health knowledge items; and eight items in each, regarding the prevention and management of dental caries, periodontal disease and oral cancer respectively. The study was conducted on 100 participants and most of them being African American. The REALM and short-TOFHLA were also administered with the CMOHK during the final data collection for this study (Macek, et al., 2010).

CMOHK was tested for validity and reliability. The reliability was supported by the high Cronbach's alpha score (0.74) (Macek, et al., 2010). CMOHK scores were calculated by

dividing the questionnaire into three categories. Scores from 0-11 were considered “poor”, 12-14 “fair” and 15-23 “good”. There was a statistically significant association found between the CMOHK and REALM (Fisher’s exact test  $P$ -value $<0.01$ ), an established health literacy instrument and this shows that CMOHK has good criterion validity. CMOHK score was not associated with short-TOFHLA and the author has explained this to be due to the small sample size (Macek, et al., 2010).

Based on the results, Macek, et al. (2010) has given a conceptual framework (see Fig-4) by expressing health literacy via four unique components: (i) word recognition, (ii) reading comprehension, (iii) conceptual knowledge and, (iv) communication skills.

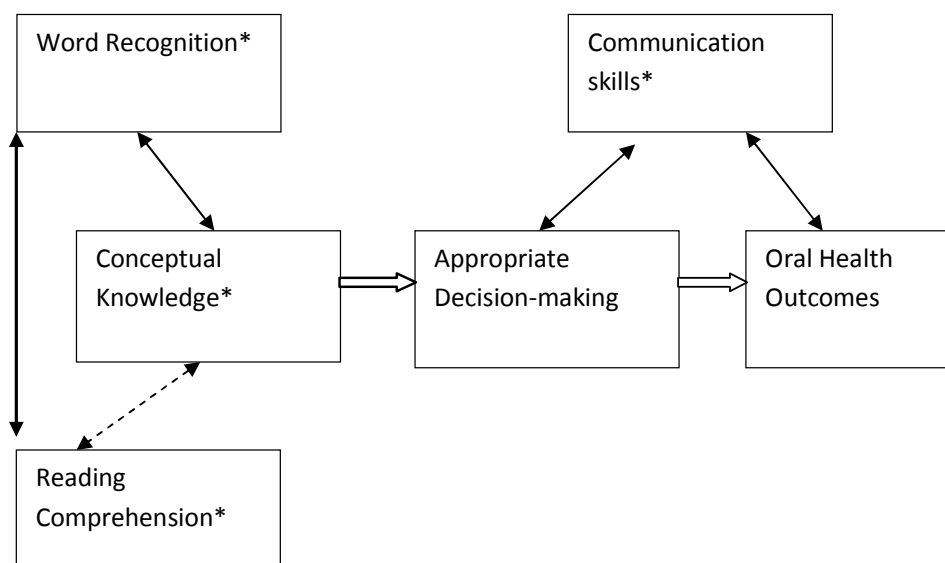


Figure 4

*Conceptual Framework for Association between Different Components of Health Literacy\* and Oral Health*

(Macek, et al., 2010).

The relationship between the components of health literacy was explored by this conceptual framework. Macek, et al. (2010) hypothesized that reading skills, word recognition and conceptual knowledge influence a person's ability to make good decisions (Macek, et al., 2010). The results showed that there were significant associations found between word recognition and conceptual knowledge (Fisher's exact test  $P\text{-value} < 0.01$ ) and between word recognition and reading comprehension (Fisher's exact test  $P\text{-value} < 0.01$ ). The analysis also indicates that there is no association between reading comprehension and conceptual oral health knowledge (chi-square  $P\text{-value} = 0.62$ ). No measures for decision making were included in that study. Macek, et al. (2010) suggested testing the patients' ability to participate in the decision making in a future study (Macek, et al., 2010).

The results indicate that there is no association between reading comprehension and conceptual oral health knowledge (Macek, et al., 2010). This finding shows that a health literacy instrument should measure both health knowledge and reading comprehension (Macek, et al., 2010). This concept was used in our research.

The REALD-30, REALD-99, TOFHLiD, OHLI, REALM-D and CMOHK instruments are used for measuring an individual's oral health literacy. Even if the concept remains constant, different measurement tools will be required for different ages and stages in life (Nutbeam, 2008). For example, knowledge about diabetes would be high in a diabetic patient compared to a cardiovascular patient. Parents are expected to have some health literacy regarding child's oral health as the primary care givers. Hence, standard measuring tools such as REALD-30, REALD-99, TOFHLiD, OHLI and CMOHK which measures adults' oral health literacy would not be suitable for measures the level of oral health literacy in parents of preschoolers.

An instrument for measuring a parent's oral health literacy was developed by Ludke, et al. (Personal communication, Robert Ludke, 2010). This instrument consists of three sections

measuring (i) knowledge, (ii) Comprehension (iii) Attitude and behaviour of parents regarding their child's oral health. The first section measures the knowledge; section two measures the comprehensive knowledge using a passage to read, questions were asked to test how they interpret the health care information; and section three consist of attitudes and behaviours of parents regarding oral health of children (Personal communication, Robert L Ludke , 2010).

The questionnaire developed by Ludke, et al.(2010) covers every aspect of health literacy such as knowledge, behaviour, attitudes, shared- decision making and service navigation (Personal communication, date, 2010). This instrument does not have any questions regarding child's teething. Parents of pre-school aged children are expected to know about teething and about managing teething problems as their primary care givers. Hence, our instrument was developed by modifying the questionnaire developed by Ludke, et al (2010) to include questions regarding child's teething.

## **2. Relevant Research**

### **2.1 Oral Health Literacy and Poor Oral Health Outcome**

In general, people have a low level of oral health literacy and it could be related to poor oral health outcome in the community. The Government has been investing millions of dollars in the development of health policies. Yet people are not becoming knowledgeable about their own healths which are linked to poor health outcomes in the community. For example, Helen, et al. (1994) has conducted a study to predict public knowledge of prevention of dental disease and showed a surprisingly disappointing result. The study was conducted during 2000 and focused on the fluoridation of public drinking water in the United States that started in some cities more than four decades before (Helen et al, 1994). However, the results showed that 93% of participants included in the survey were unaware of the relative importance of community water fluoridation and other fluoridation in caries prevention (Helen et al, 1994). In that study, 68% of the adult population were unaware of dental sealant as caries prevention (Helen et al, 1994).

### **2.2 Health Literacy among Adult Dental Research Population**

A study was conducted in Indiana University School of Dentistry, United States of America to investigate the level of health literacy among adults who frequently participate in oral health research programs (Jackson, Eckert, & Mas, 2008). Health literacy was measured using the short-TOFHLA in a convenience sample of 99 adults who frequently participate in health care studies. Demographic and socio-economic data was collected using an additional questionnaire. The results indicated that 13% of the participants scored under inadequate or marginal categories as described by the criteria used in the short-TOFHLA (Jackson, et al., 2008).

Based on the results, the author stated that older adults may have difficulty in reading health care instructions such as informational letter, consent form, prescriptions and other documents (Jackson, et al., 2008). Jackson, et al. (2008) suggested for the future researchers to make every effort to ensure that the information supplied in the text form is provided in an “easy to understand manner”. Low health literacy may affect an individual’s decision to participate as a research subject. Misunderstanding of the information and consent form may lead to incorrect and irrelevant response of the survey questions and this may possibly affect the results of the study (Jackson, et al., 2008).

### **2.3 Knowledge of Behaviour**

A study was conducted in Australia to find the relation between knowledge of behaviours and oral health outcomes (Brennan, Spencer, & Roberts.Thomson, 2010). Brennan, et al. (2010) indicated that knowledge of oral health behaviour should underpin positive dental behaviours and result in better oral health outcomes. Brennan, et al. (2010) argued that the cost of dental care may restrict the dental visiting behaviour among those on lower incomes. Non-cost behaviour such as availability of dental providers and language barriers may hinder access to dental care as well (Brennan, et al., 2010).

The aims of the study were to assess the role of knowledge on behaviours in prevention of dental caries and to determine whether this dental knowledge was associated with socio-demographic parameters (Brennan, et al., 2010). A random sample of 2248 persons aged 45 to 54 years was surveyed by mailed questionnaire. A total of 879(39%) persons returned the questionnaire and 709 (32%) participants were examined for decayed, missing, and filled teeth (DMFT) (Brennan, et al., 2010).

The questionnaire included dental knowledge of the prevention of tooth decay including visiting a dentist regularly, drinking water with fluoride, regular brushing of teeth, regular flossing of teeth, using fluoride toothpaste, using fluoride mouth rinse and avoiding sweets between meals (Brennan, et al., 2010). Dental knowledge scores were calculated by adding the responses to the dental knowledge and arbitrarily dividing the participants into higher and lower knowledge categories (Brennan, et al., 2010).

The results showed that there was a high association ( $P < 0.01$ ) between knowledge and of behaviour and oral health (Brennan, et al., 2010). Participants with high dental knowledge had more number of filled teeth than decayed teeth. Participants with higher education and higher income households had fewer decayed teeth and fewer missing teeth with a low DMFT index. Female participants had high dental health knowledge and fewer decayed teeth than male ones (Brennan, et al., 2010)

This study suggests that dental behaviour plays a mediating role between dental knowledge and oral health (Brennan, et al., 2010). Therefore, health knowledge and health behaviour could be mutually reinforcing, for example, behaviour such as making a dental visit may provide the opportunity to acquire knowledge of the value of a regular visiting pattern and improved self-care behaviour (Brennan, et al., 2010). The concept of testing the mutually reinforcing relation between the knowledge of behaviour and attitude has been used in our study.

Taylor, et al. (2005) suggested future research was needed to develop a short oral health literacy instrument. They also indicated that such oral health literacy should measure the relation between literacy skills and outcomes such as awareness of the importance of oral health to general health, knowledge of specific oral health behaviours, oral hygiene, disease

management, and participation in screening programs (Taylor, et al., 2005). Our questionnaire was short and was developed to measure the above factors.

Andersen and Davidson (1997) provided a framework describing the relationships between the characteristics of the external environment, dental care delivery system, and the personal characteristics of the population that influence oral health outcomes. They also denoted that health behaviour as an important influencing factor for oral health outcomes (Andersen & Davidson, 1997).

## **2.4 Knowledge of Self-Examination**

Rubinelli, et al. (2009) argues that there is link between health literacy and behaviour, but that link is neither necessary nor sufficient. The author illustrates this with two examples as follows (Rubinelli, Schulz, & Nakamoto, 2009).

“Example: 1 Andrew, who has working in an institute of preventive medicine, has been asked to design an anti-smoking campaign. He has all knowledge necessary to design the campaign; numerous medical reports on the risk of smoking and techniques to quit smoking. Nevertheless, he himself is a smoker and has no intention of giving it up” (Rubinelli, et al., 2009).

In this example, because Andrew exhibits smoking behaviour, it doesn't mean lack of health literacy (Rubinelli, et al., 2009). The behaviour of functionally literate people like Andrew who do not act accordingly is explained by giving priority to pleasure of smoking over the negative health consequences of smoking (Rubinelli, et al., 2009).

“Example 2 Karen goes to the gym 4-5 days every week for at least an hour performing aerobic exercises good for strengthening her heart as well as staying in shape. She is rigorous



in her food intake, limiting sugar, animal fat, and caffeine. Karen appears to be showing great health literacy and empowerment. Yet, we discover that, far from thinking about her health, Karen does all this because her boyfriend Jason is the owner of the gym and she is often depressed as she struggles to “look the part” of Jason’s girlfriend” (Rubinelli, et al., 2009).

In this example, Karen is demonstrating good health behaviour but her health behaviours are not oriented towards self promotion of health (Rubinelli, et al., 2009). The characteristics of the external environment, health care delivery system and personal characteristics of population influence health behaviours (Andersen & Davidson, 1997). Personal characteristics which influence oral health behaviours are gender, marital status, length of time in the community, acculturation, language, educational level, occupation and health beliefs (Andersen & Davidson, 1997). Nakazono et al. (1997) denoted that oral health beliefs are predisposing factors for oral health behaviour. Health beliefs and personal preferences are perceived by the individual and personally evaluated by the health care providers (Andersen & Davidson, 1997).

Rubinelli, et al. (2009) argued self-examination as an important factor in deciding the level of health literacy (Rubinelli, et al., 2009). Self-examination generates the ability to appreciate health information by recognizing those personal needs or limitations that can prevent its full appraisal and application in good health decisions (Rubinelli, et al., 2009). The critical self-examination is the context in which health literacy related skills come into play (Rubinelli, et al., 2009). The author pointed out that literate persons are able to accept the need to consult an expert. He added as well that patients should not expect to become experts (Rubinelli, et al., 2009). Rubinelli, et al. (2009) defines health literate persons as “Patients who can make clear their health concerns, not only in terms of disease or disability but also in terms of health as an integral element of life”. The questions about testing the knowledge about monitoring

teething and examining the problems due to teething was added in our questionnaire based on this concept.

## **2.5 Oral Health Knowledge of Plunket Nurses in New Zealand**

In New Zealand, parents receive their first oral health advice from Plunket nurses who provide baby care and support for their families (Drummond, Clarke, Maxwell-McRae, Konthasinghe, & Thomson, 2002). A study was conducted to evaluate oral health knowledge of Plunket nurses. The study was done by comparing oral health knowledge of Plunket nurses who had completed the oral health module introduced in 1990 and the ones that haven't (Drummond, et al., 2002).

The questionnaire used in the study was developed to explore the Plunket nurses' knowledge of oral health and related issues (Drummond, et al., 2002). Three hundred and five Plunket nurses were invited to participate in the survey. Only two hundred and two questionnaires (66%) were returned. The response rate was high in Auckland region (62%) compared to the one in central (42 percent) and Southern region (43 percent). The study concluded that oral health knowledge of Plunket nurses was adequate for nurses who completed the oral health module (Drummond, et al., 2002).

A number of important barriers to the uptake of preschool dental care were identified in that study (Drummond, et al., 2002). The major barriers to access dental services were difficulties in accessing a dental therapist, parents' lack of awareness of services, transport difficulties and parents' lack of knowledge and motivation (Drummond, et al., 2002). These barriers can be due to the lack of health literacy among New Zealand parents. The Plunket nurses in New Zealand have good oral health knowledge, hence Plunket nurses should be considered in oral health literacy programs. Parents should be informed through Plunket nurses about the

availability of free oral health services and how to access them. Plunket nurses should encourage parents to make the first dental visit when their child turns one.

## **2.6 Health Literacy of Refugees and Immigrants**

Refugees and immigrants are at more risk among the general population for poor oral conditions due to factors such as untreated oral condition, prior to immigration and less access to services (Brown, Canham, & Cureton, 2005). Brown, et al. (2005) indicated that increasing access to the health care for lower socio economic groups alone, does not change their oral health status. Instant oral health education and change in social health policies will improve the oral health status (Brown, et al., 2005). Hence, due to an increase in the diversity of cultural and ethnic communities in New Zealand (Wilson, 2006); there might be differences in health knowledge among New Zealand and immigrant parents. The level of health knowledge of immigrant parents should be identified and oral health education programs should be tailored to cultural specificity. Interpreters should be used in the health care settings to improve non-English speaking refugees' access to oral health services.

Wilson (2006) has conducted a study to establish how often interpreters are used by the health care workers and to identify problems in accessing appropriate interpreters in New Zealand. The response rate in this study was 90 percent (Wilson, 2006). The study included six questions regarding awareness of interpreting policies, problems with implementing policies, frequency of use, and identifying any access difficulties and other barriers for using interpreting services (Wilson, 2006).

Most of the clinical nurse managers (91 percent) were aware of interpreting services. Thirty percent of them experienced access difficulties (Wilson, 2006). The problems identified were the reduced number of highly qualified interpreters, the use of untrained interpreters, using

interpreters who were known to the clients, gender issues and accuracy of interpreted information. The key problem was the cost of interpreting services (Wilson, 2006).

In conclusion, the Government policies should be enhanced to increase interpreting services' availability in order to improve participation of non-English speaking individuals in the health care decision making. As stated above before, shared decision making with the help of interpreters will improve their health literacy. Health care materials and brochures' should be available in all commonly used languages in New Zealand. For example, the New Zealand transport agency has been conducting driving exams in nine different commonly used languages other than English (New Zealand Transport Agency, 2010). If people use that facility for the licence exam, it suggests that immigrant population might find difficulty in reading and interpreting English, which would be an issue in the health setting as well.

## **2.7 Oral Health Literacy of the Indigenous Population in Australia**

A study has been conducted in Australia in order to determine the oral health literacy- related outcome associations (Parker & Jamieson, 2010). This study was conducted also to determine whether oral health literacy- related outcomes are risk indicators for poor self-reported oral health among rural-dwelling indigenous Australians. In Australia, Indigenous Australians have poorer self-reported health compared to non-indigenous Australians. Poor oral health outcome is persisting in indigenous Australians compared to non-indigenous population (Parker & Jamieson, 2010).

The instrument used in this study to determine health literacy was REALD-30. A self-reported questionnaire was included with REALD-30 in this study, which was also used by the Australian Research Centre for the population Oral health in other population-level surveys (Parker & Jamieson, 2010). The self-reported questionnaire was pilot tested with 5

indigenous Australians and modified according to their comments. Oral health literacy related outcome defined in this study was oral health knowledge, oral health self-care and utilization of services. Oral health literacy related outcomes were examined by another questionnaire containing five questions such as What was the reason for the last dental visit, Do you own a toothbrush?, Did you brush your teeth yesterday?, and how many times a day should you brush your teeth? (Parker & Jamieson, 2010)

The findings of this study confirm that people with poor oral health literacy had poorer oral health knowledge and engaged in more harmful oral health- related behaviours (Parker & Jamieson, 2010). The results also suggest that poor oral health literacy related outcomes were risk indicators for self-reported oral health (Parker & Jamieson, 2010). This study showed the relationship between oral health literacy and oral health knowledge and effect of poor oral health knowledge in oral health related behaviours. Indigenous children in Australia have poor dental health outcomes associated with higher level of untreated dental caries and less preventive therapies compared to non-indigenous Australian children (Parker & Jamieson, 2010). This might be due to poor oral health knowledge among Indigenous parents, although this conclusion needs confirmation by further research.

## **2.8 Relevant work in New Zealand**

In New Zealand a study (Korero Marama) was conducted to describe the health literacy skills of the adult Maori population compared to the adult non-Maori population (Ministry of Health, 2010d). The data in this research was drawn from the 2006 Adult Literacy and Life Skills Survey which measures the literacy skill level of the New Zealand population. This study presented the findings for Maori compared to non-Maori by gender, age, rural and urban location, level of education, labour force status and income (Ministry of Health, 2010).

The overall finding suggested that most of Maori and Non-Maori New Zealanders (56.2%) have limited ability to obtain, process and understand basic health information and services in order to make informed and appropriate health decisions (Ministry of Health, 2010d). Maori have poorer health literacy skills compared to non- Maori. Eighty percent of Maori men and seventy percent of Maori women have poor health literacy (Ministry of Health, 2010d).

A survey was recently conducted by Ministry of Health to develop a pilot on-line cultural competency training tool (Ministry of Health, 2010a). The purpose of this survey was to examine the knowledge of cultural competency and health literacy as well as its relevance within the health literacy. The participants in this survey were health care workers and non health care workers. The survey was sent out to 2000 participants on the 5<sup>th</sup> of July 2010. Out of those only 459 (23%) returned the filled out surveys by 9<sup>th</sup> of August 2010 (Ministry of Health, 2010a).

Ninety percent of participants were self-reported as health care workers and ten percent as non- health care workers. Different sets of questions were designed for health care workers and non- health care workers (Ministry of health, 2010a).

Non-health care workers were asked to rank in order of high importance for a health care worker to know and understand (Ministry of health, 2010a). The options to rank were communication skills, knowledge of different cultures, and knowledge of current health disparities, health literacy and impact of healthcare worker behaviour on clinical outcome. The majority of the participants ranked health literacy in second place (Ministry of health, 2010a).

Health care workers were asked to rank options in order of importance for a healthcare worker to know and understand (Ministry of health, 2010a). The options given for health care

workers were different from the ones given to the non-healthcare workers. Those were communication skills, knowledge of different cultures, current health disparities, health literacy, Maori health, and impact of health care worker behaviour on clinical outcomes. Healthcare workers ranked health literacy in fourth place and Maori health and impact of health care workers behaviour and clinical outcomes in second and third place. Seventy percent of health care workers reported having problems due to lack of health literacy. Forty eight percent of the health care workers said they never had any training in health literacy. Approximately 80% of health care workers said they, would like further training in health literacy (Ministry of health, 2010a).

Recently a website ([www.healthliteracy.co.nz](http://www.healthliteracy.co.nz)) has been launched (28<sup>th</sup> September, 2010) in New Zealand to help in achieving a high level of health literacy in New Zealand (Health Literacy New Zealand, 2010). This website provides free comprehensive information about health literacy and associated resources for a range of groups working in the health sector and New Zealanders in general and adult literacy in New Zealand (Health Literacy New Zealand, 2010). This website will possibly increase the awareness of health literacy among health care workers and general public. It will be interesting to evaluate the impact of the website on health literacy levels in New Zealand in the future.

## **2.9 Health Literacy Statistics**

The level of health literacy among New Zealand adults is comparatively higher than Canada and United States of America (see Table-2) (Health Literacy statistics, 2010). The level of health literacy among Australian adults is very similar to New Zealand adults (see Table-2 below) (Health Literacy Statistics, 2010).

Table 2

*Health Literacy Statistics* (Source: Health Literacy statistics, 2010)

Country	Percentage of poor health literacy (Adult-16-65 years)
New Zealand	56.2
Australia	57.0
Canada	60
United States of America	28 (whites) 57 (Black) 65 (Hispanic)

A study was conducted in Christchurch, New Zealand to examine the concept of health literacy and its relevance to the production of health promotion resources for disadvantaged groups (Witt, 2007). A postal survey was conducted involving health promoters in non Government organisations and focus groups in socio-economically disadvantaged communities (Witt, 2007). The results of survey indicated that only less than half of the health promoters were aware of the term health literacy. The study also indicated that health promoters understood and practised basic principles for the health literacy (Witt, 2007).

Hence, while the body of the health literacy is growing in New Zealand, there is little work done in oral health literacy in New Zealand creating a gap in research (Taylor, et al., 2005). Preventable and treatable oral diseases are widespread in the community in spite of having advanced technology in dentistry to treat them. Surveys indicate that there is lack of awareness persisting among general public about relationship between oral health and general health (Rudd & Horowitz, 2005). Research suggests that there are associations between



chronic oral infections and heart and lung diseases, diabetes, stroke and pre-term low birth weight. Most oral diseases are preventable and controllable (Rudd & Horowitz, 2005). Financial issues are most frequently argued for the lack of treating oral diseases (Taylor, et al., 2005). There are various other reasons proved to be the cause for poor oral health outcomes, with health literacy believed to be an important element in determining oral health (Rudd & Horowitz, 2005; Taylor, et al., 2005; Witt, 2007). Oral health literacy motivates everyone to prefer a pathway that leads to a health promoting behaviour (Taylor, et al., 2005). A literacy pathway to oral health is largely invisible and little understood in the community (Taylor, et al., 2005). Therefore, more research is needed in this area to identify and understand the literacy barriers to the oral health.

### **3. Why parents need oral health literacy?**

Childhood takes place at home and the mother is considered as the primary role model for behaviour (Okada, et al., 2002). Early childhood caries are preventable only with the help of the parent (Okada, et al., 2002). Health promoting behaviours are not developed until a child reaches 3<sup>rd</sup> or 4<sup>th</sup> grade (Okada, et al., 2002). Okada, et al. (2002) indicated that the more positive the mother's attitude regarding her child's oral health, the fewer caries that the child had.

#### **3.1 Effect of Parent's Knowledge and Education on Child's Oral Health**

A randomized controlled study was conducted in Australia to test the efficacy of an oral health promotion programme for the parents of infants (Plutzer & Spencer, 2008). The results show that the low incidence of Early Childhood Caries in the intervention group (1.7%) compared to control group (9.6%) at  $P < 0.001$  (Plutzer et al, 2007). The study was conducted in 649 Australian women and anticipatory guidelines were initiated during the pregnancy, which gave successful results (Plutzer et al, 2007). In this study, oral health knowledge of parents has been reflected in children's oral health; hence improving parents' oral health knowledge looks to be related with improved oral health status of their children.

Another study was conducted in Nebraska, USA to test the effect of oral health education. The participants were parents of three and six months aged children (Rothe, Kebriae, Pitner, & Balluff, 2009). The participants were asked to complete a questionnaire consisting of 16 questions before and after watching a thirty minutes oral power point presentation (Rothe, et al., 2009). On the pre-test 28% had a score of 70% or less and in post test 87% of parents got a score of more than 88% (Rothe, et al., 2009). In that 80% of the parents reported that the

presentation was helpful and indicated that it will improve their child's oral health (Rothe, et al., 2009).

In North Carolina, a cross sectional survey was conducted to determine the relation between caregiver's literacy and children's oral health outcome (Miller, Lee, DeWalt, & Vann, 2010). The study was conducted in 106 children by conducting a complete oral examination accompanied with measures of oral health knowledge and oral health behaviour of caregivers. In this study, 86 percent of the participants were children's mothers similar to other studies involving parents. The oral health knowledge was measured using REALD-30 questionnaire. The bivariate results showed no significant relation between literacy and caregiver's oral health knowledge and oral health behaviour. But there was an association between literacy and oral health status. Parents of children with high treatment needs had less REALD-30 score compared to parents of children who required lower and moderate treatment needs (Miller, et al., 2010).

A study in Brazil, conducted to understand the level of parents' and caretakers' knowledge about avulsion of teeth showed that the level of parent and caretaker knowledge concerning management of avulsion was significantly low, without any association with age, education and monthly family income, (Santos et al, 2009). Managing the avulsed tooth is very important otherwise the child has to depend on the artificial tooth for his or her lifetime. The literacy level of Brazil is 91% (UNICEF, 2008) and this illustrates that level of literacy is different from level of health literacy.

A cross sectional study carried over in 1217 of 12 year old school children in Galiza (North West Spain) denoted the relation between mother's level of education and prevalence of dental caries. The higher the mother's level of education, the greater the subject's knowledge

of dental health which was directly proportional to lower level of prevalence of dental caries in children (Smyth & Caamaño, 2005).

### **3.2 Effect of Parent's Dental Beliefs, Attitude and Behaviour in Child's Oral Health**

A study was conducted in Norway, to find the parents' dental beliefs and attitudes towards their child's oral health. The data was collected at the age of three and at the age of five and there was positive significant change in dental attitudes shown at the age of five compared to at the age of three among European parents and there was no significant change showed in the immigrant parents (Skaret, Espelid, Skeie, & Haugejorden, 2008) Another important finding in that study was that the dental attitudes of the European parents at the age of three were lower than at five. This has a negative impact on prevention of early childhood caries.

Faye, et al. (2009) showed that there is a strong relationship between parents' oral health status and children oral health status. The children's oral hygiene habit and their parent's habit were associated in their study (Faye et al, March, 2009, p.5). A study in 1443 mothers and their children concluded that children's DMF index is strongly associated with their mother's irregular tooth brushing habit (Mattila, Rautava, Sillanpaa & Paunio, March, 2000, P.877). Sasahara, et al. (1998) reported the relation between mother's positive attitude and fewer dental caries in 5-6 years old. In that study, children of parents with a healthy attitude had better oral health (Sasahara, kawamura, Kawabata, & Iwamoto, 1998).

The vertical bacterial colonization of mothers to their infant is well documented in the literature (Weiss, et al., 2003). Streptococcus mutants in oral flora appear to be identical for infants and mothers in 71% of mother-infant pairs in a study (Weiss, et al., 2003). A clinical observation study suggests that an acidic shift is caused in the pregnancy which increases the

growth of bacterial flora and it appears to be normal only after two years post pregnancy (Weiss, et al., 2003). Hence at this period, the chance of vertical colonization from a mother to child is high. Mothers are expected to follow the oral hygiene procedures to control the growth of bacteria in their mouth.

A study was conducted in Uganda to investigate parents' attitude towards controlling their children's sugar consumption (Astrom & Kiwanuka, 2006). This study revealed the relationship between mother's education and mother's intention to control the child's sugar consumption (Astrom & Kiwanuka, 2006). The clinical examination in the study showed that there was high DMFT rate in children from the lower socio-economic group (Astrom & Kiwanuka, 2006).

A study was conducted in Jordan to investigate the association of oral health to socio-demographic factors, oral hygiene behaviours, infant feeding and dietary practices in 4-5 year old Jordanian children. One relevant finding in that study was that children from a less advantaged background had high prevalence of dental caries (31% had DMFT rate greater than 4 and 66% had gingivitis) associated with prolonged breast feeding behaviour of mothers (Sayegh, Dini, Holt, & Bedi, 2005).

Mattila, et al.(2000) demonstrated in their study that mother's supporting role positively reflects on twice daily tooth brushing habit and the mothers should be considered for preventive and promotional programmes for preadolescents (Mattila, Rautava, Sillanpää, & Paunio, 2000). In everyday life, parents are powerful role models to the children and parents dental hygiene knowledge and oral hygiene has a significant impact on early childhood caries and preventive dentistry (Mattila et al, 2000).

Novel behaviours such as tooth brushing behaviours have been shown to come from parents (Okada, et al., 2002). Okada, et al. (2002) conducted a study in Hiroshima to determine if there was parental influence of dental behaviours in children and reported the direct influence of parents' behaviour to children's number of decayed teeth and parents' gingival health to children's gingival health.

### **3.3 Parents' Knowledge about Teething**

Owais et al (2010) conducted a cross-sectional survey in Jordan to find the parents' knowledge about children's teething. They concluded that most of the parents (almost 75% of participants) had myths regarding teething. One interesting and unexpected finding in this study was the lower level of knowledge among parents working in the health sector (Owais, Zawaideh, & Bataineh, 2010). The author has explained this due to lack of proper information regarding teething in the medical curricula. The people working in the health sector may have recall bias as they see repeated complaint about teething. Hence, this makes them to start to believe falsely in the signs and symptoms related to teething. The localised symptoms of teething vary between individuals. Severe systemic disturbances like vomiting, diarrhoea, fever more than 38.9 degrees or any other serious illnesses are not considered to be associated with teething (Owis et al, 2010; Wake et al, 2000).

Wake, et al (2000) published a community based survey and showed that 70%, 36%, 78% and 41% of Australian parents believed that teething causes fever, diarrhoea, sleep disturbances and runny nose respectively. In another study conducted by Swann (1979), who reviewed 50 children admitted to hospital with a presenting complaint of teething, 48 children were diagnosed with a medical condition including a case of bacterial meningitis. If medical conditions like bacterial meningitis is misunderstood for teething and if parents try to self

manage with Paracetamol, the child's life would be at risk. Parental false beliefs about the signs and symptoms associated with teething may interfere with the prompt diagnosis and management of a range of serious illnesses (Owais, et al., 2010). Hence, this indicates that the lack of health literacy among parents' might put the child's life at risk

A cross sectional study involving 322,959 adolescents from research centres across 50 countries was conducted to find the relationship of Paracetamol use and incidence of asthma (Beasley, et al., 2010). This study was conducted by completing written and video questionnaires which concluded there was a relationship between Paracetamol usage in 1<sup>st</sup> year and incidence of asthma in 6-7 years of age. Hence, frequent Paracetamol usage is not recommended in young children. A study has been conducted to find the pharmacological approach followed by parents to manage teething problems (Owais, et al., 2010). This study revealed that 86% of parents reported the use of Paracetamol and 52% reported using topical anaesthetic based teething gels (Owais, et al., 2010). In another study, Wake, et al. (2000) has identified 41% of pharmacists recommending sedating medication for customers with teething problems. This study shows the low level of health literacy among some health professionals.

Therefore, children's oral health is strongly correlated to parent's oral health status and their knowledge on prevention of diseases. The knowledge and experience of the parents has not been identified. Health literacy will benefit the quality of patient's care and in turn, the quality of life, but these facts have been largely ignored in the past. By determining the level of oral health literacy of parents in the Christchurch region, the oral health status of Christchurch children can be improved. There is no literature available to know the oral health literacy level among New Zealand parents, and thus this research will show us the level of oral health literacy in a sample of New Zealand parents. "There is nothing more precious to a parent than

a child, and nothing more important to our future than the safety of all our children” (Bill Clinton, year not found).

#### **4. Key Observations from the Literature Review**

In summary, the key observations from the literature review include:

- Oral health literacy is different from general health literacy (Andersen & Davidson, 1997; Taylor, et al., 2005).
- Instruments available for measuring oral health literacy are REALM-30, REALM-99, REALM-D, TOFHLiD, OHLI and CMOHK (Atchison, et al., 2010; Gong, et al., 2007; Jones, et al., 2007; Lee, et al., 2007; Macek, et al., 2010; Richman, et al., 2007)
- REALM-30, REALM-99 and REALM-D are word recognition systems in which participants were asked to read the words loudly in front of interviewers (Atchison, et al., 2010; Lee, et al., 2007; Richman, et al., 2007).
- The oral health literacy instrument for adults (OHLI) measures numeracy skills and comprehension skills (Sabbahi, et al., 2009).
- CMOHK measures the conceptual knowledge of the participants in the context of health literacy. This measure demonstrated that there is a relationship between word recognition and comprehension and there is no association between comprehension and oral health knowledge. This indicates that a health literacy instrument should contain measure for both comprehension and oral health knowledge. This also indicates that word recognition instrument can be used for measuring comprehension knowledge of an individual (Macek, et al., 2010).



- Word recognition systems do not measure health literacy completely and have some disadvantages such as a failure to test measure of oral health knowledge (Atchison, et al., 2010; Lee, et al., 2007; Richman, et al., 2007).
- The oral health literacy instrument should be a short and easy to measure without any special interviewer with expert knowledge required to use (Baker, 2006; Taylor, et al., 2005)
- Individual with high oral health knowledge have healthy oral behaviour and better oral health outcome (Brennan, et al., 2010).
- Oral health behaviour may be altered by various factors such as the external environment, the health care delivery system and personal characteristics. Personal characteristics which influence oral health behaviour are gender, marital status, length of time in the community, acculturation, language, educational level, health beliefs and occupation (Rubinelli, et al., 2009).
- Self-examination is considered another factor in deciding the level of health literacy (Rubinelli, et al., 2009).
- Health literate patient is expected to have knowledge about oral health, healthy behaviour (disease prevention), healthy attitudes (disease management), a relationship between oral health and general health, disease management, health promotion self-examination and system navigation (Atchison, et al., 2010; Baker, 2006; Brennan, et al., 2010; Ministry of Health, 2010b; Jones, et al., 2007; Lee, et al., 2007; Macek, et al., 2010; Richman, et al., 2007; Rubinelli, et al., 2009; Sabbahi, et al., 2009; Taylor, et al., 2005) An individual with above qualities will actively engage in shared-decision making and improve his/her oral health knowledge.

## 5. Common Findings in Past Studies

- Overall average oral health literacy level among the population appears to be low (Atchison, et al., 2010; Baker, 2006; Brennan, et al., 2010; Ministry of Health, 2010b; Jones, et al., 2007; Lee, et al., 2007; Macek, et al., 2010; Richman, et al., 2007; Rubinelli, et al., 2009; Sabbahi, et al., 2009; Taylor, et al., 2005).
- Generally, female participants have high oral health literacy compared to male participants (Jones, et al., 2007; Macek, et al., 2010; Sabbahi, et al., 2009)
- Education and oral health literacy are associated with each other. Participants with University education have high oral health literacy (Lee, et al., 2007; Macek, et al., 2010; Richman, et al., 2007; Sabbahi, et al., 2009).
- Older adults have less level of oral health literacy compared to younger adults.
- Participants with high household income have better oral health literacy compared to others (Lee, et al., 2007; Macek, et al., 2010; Richman, et al., 2007; Sabbahi, et al., 2009).
- Indigenous population in Australia and New Zealand have poorer health literacy compared to others (Ministry of Health, 2010b; Parker & Jamieson, 2010)
- Studies involving parents of children show, a participation rate of a significantly higher proportion of females compared to males (Gong, et al., 2007; Rothe, et al., 2009)

## **Chapter Three: Methods**

The participants of this study are the parents or caregivers of children enrolled in pre-schools in Christchurch city. A cross sectional quantitative study was conducted between 15<sup>th</sup> August 2010 and 15<sup>th</sup> September 2010. We selected a convenient sample of five pre-schools for our study. Two of them are located outside the campus (ABC Early Learning Centre and Annabel's Early Learning Centre). The other three are located inside the University campus (Ilam early learning centre, Montana early learning centre and early years care and education).

We submitted the proposal and the survey package to the preschools' management office and received permission to recruit participants from the preschools. Permission to recruit parents from preschools was approved by all the preschools with the exception of the "Early years learning and education". Consent had to be received from the research advisory committee, formed by the preschool management. One of the committee's members had resigned his/her job at the time of the study and without all members' signature the approval could not be given.

The 380 questionnaires were distributed to all the parents of children enrolled in the pre-schools. The parents were requested to fill in the questionnaire. A special drop box was left in each pre-school for their collection.

### **1. Design of the Survey**

The questionnaire was based on an earlier validated survey developed by Ludke et al (2010).

The survey was a self-administered written questionnaire and consists of 3 sections and 33 questions (see Appendix A)

Section one was designed to measure the oral health knowledge of the parents. The questions were designed to test the parents' knowledge about basic dental knowledge (Question number-1, 4, 6,16, 17), Oral health promotion (Question number-2, 5&13), oral health protection (Question number-5,14 & 15), Disease prevention (Question number-3,7,8,9,11,18 and 19) Health care and maintenance (Question number- 20, 21,22,23 and 24) and system navigation (Question number-10). Most of the questions were about early childhood caries (ECC) because ECC is considered as the major oral health problem among preschoolers.

Section two was based on Ludke's questionnaire and to test the parent's ability to understand health care instructions using their comprehension skill.

Section 3 contains demographic data to compare parent's health literacy level with socio-demographic parameters. This part of the questionnaire was modified according to New Zealand population by refereeing Owis et al's (2010) study which matches the current study population. An average of five minutes was required to complete the questionnaire.

## **2. Modifications**

The survey was a modified version of standard/original questionnaire developed by Ludke et al (2010). We received the questionnaire (see Appendix B) and the summary of validation report (see Appendix C) by communicating personally with the author. The author has granted permission to use and to make necessary modifications according to our study design and research questions (See Appendix -D and -E).

**Additional questions included in this survey:**

13. The best fluoride tooth paste for your child is

- 0.22% Sodium Fluoride
- 0.11% Sodium Fluoride
- Sodium mono fluorophosphates-7.6 mg/g
- Don't Know

This question was included in order to identify whether the parents had the knowledge about fluoride concentration in adult's and child's toothpaste, available as over the counter in commonly sold brands of toothpaste. This question was added also to find out if they are aware of the different percentage of fluoride in adults and child's toothpaste. The answer options for this question were selected by examining different brands of toothpaste available in the supermarkets and pharmacies, for over the counter regular use toothpaste products.

14. The fluoride in drinking water causes

- a. Systemic diseases
- b. Prevents dental decay when concentration is 1ppm
- c. Makes teeth brittle and weak
- d. Don't know

This question was included in the questionnaire to identify parents' knowledge about water fluoridation and their awareness of the beneficial effect of fluoride in preventing dental decay. The options "systemic diseases" and "makes teeth brittle and weak" were selected on the

basis of belief that those who campaign against fluoridation of toothpaste in New Zealand (Connett, 2005)

15. Do you think the Christchurch water supply should be fluoridated?

- a. Yes
- b. No

The purpose of this question was to identify the attitudes of the parents about water fluoridation in Christchurch.

Three questions were added to identify the knowledge of the parents about teething in children and problems associated with teeth eruption. These questions about teething are based on the article “Challenging parents’ myths regarding their children’s teething” published by Owis et al (2010). The options for these questions were chosen by evaluating the findings and results in the above mentioned study.

Owis et al. (2010) found that nearly 23% of parents did not know the correct age of child’s first tooth eruption. Hence, the following question was included to determine the parents’ knowledge on monitoring child’s tooth eruption in current study.

16. Generally, the first teeth appears in the mouth at the age of

- a. 6-7 months of age
- b. 10-12 months of age
- c. 1-2 years of age
- d. don’t know

A considerable number of parents in that study disagreed (21.8%) or did not recognize the systemic disease as a reason for delayed eruption of teeth (14.7%). As a result the following question was included (Owais, Zawaideh, & Bataineh, 2010). There is common myth believed by parents relating teething with breast feeding and thumb sucking (Obrien, 2009; Happy mothers, Breast fed babies, 2006). Consequently options “Breast Feeding” and “thumb sucking” were added to this question.

17. The delayed eruption of teeth may be due to

- a. Systemic diseases
- b. Breast feeding
- c. Thumb sucking
- d. Don't know

Owis, et al. (2010) had identified that the majority of parents falsely believed that fever (84.9%) and runny nose (27.6%) are signs and symptoms of teething. More than systemic disturbances local symptoms such as desire to bite, increased salivation and gum irritations are considered as the main discomfort while teething (Owais, et al., 2010). Hence, the following question was added to the questionnaire.

18. Teething causes

- a. Fever >38.9 degrees
- b. Desire to bite
- c. Runny nose
- d. Don't know

Owis, et al. (2010) indicated that 11.3% of parents allowed nursing and bottle feeding during the night which is not a recommended practice to manage pain due to teething. The following question is added to analyse parents' knowledge on managing pain due to teething.

19. To manage pain due to teething

- a. Allow nursing or bottle feeding in the night
- b. Rub the gum
- c. Allow child to bite chilled object
- d. Don't know

### **3. Validity and Reliability**

The oral health literacy instrument developed by Ludke et al (2010) was tested for validity. The psychometric testing was done for the original questionnaire. The values for internal consistency, unidimensionality, test-retest reliability, criterion validity, discriminant validity, construct validity are provided in the summary table (see Appendix- C).

The modified version of Ludke's Oral health literacy instrument was pilot tested for the current survey research among 10 participants matched with the participants of the study to age, gender and socioeconomic status to assess the face validity of the questionnaire.

Pilot survey has been conducted in two stages to test the validity of the questionnaire. The participants selected for the survey were parents of pre-school aged children which was identical to the proposed population group. It has been conducted to identify the range of possible comments for each question.



**Acceptability** of the questionnaire was evaluated by including non-Maori (Pakeha=2), Maori (N=5) New Zealander's and immigrant population (N=3) in the pilot survey. The participants were asked to write their comments at the end of the questionnaire for the following Questions;

Do you understand all the questions in the questionnaire?

Do you understand all the words in the questionnaire?

Are you personally having discomfort with any of the questions or any of the words included in the questionnaire?

How long you took to complete the survey?

Would you like to participate in the second stage of the survey?

#### **Test-retest reliability**

The test was completed with 3 participants who accepted for the second stage of survey. Two non- Maori and one Maori who accepted were asked to fill in the same questionnaire and their responses were compared. The responses given by the three participants were the same in both stages. Based on the results of the pilot survey and observations in literature review section three of the Ludke's questionnaire was omitted.

#### **4. Ethical Considerations**

Ethics approval was obtained from the University of Canterbury Human Ethics Committee (see Appendix F). An outline of the study was provided to all participants in the survey (see Appendix G). A consent form including the researcher's contact details (see Appendix H)

were given to each participant in case of clarification or support needed in any stage of the study.

## **5. Data collection procedures**

The parents were invited to participate in the survey by various means. Invitations were included in newsletters, sent via e-mails or just posted on school notice-boards. Parents or care givers were eligible to participate if they had children of age five years or below under their care.

Every parent received a survey package. The package contained an information sheet, the questionnaire, a consent form and an envelope. Parents were requested to participate in the questionnaire. A special drop box was left in each pre-school for their collection. The “Dental health survey” drop box has been kept near the register by the preschool entrance from the 15<sup>th</sup> of August until the 15<sup>th</sup> of September 2010. Approximately 380 parents/guardians of children 0-5 years of age have received the survey package and requested to complete the oral health literacy assessment instrument. The parents/ guardians were informed about the end date of the survey. By 15<sup>th</sup> of September, 117 completed questionnaires were collected from the preschools. Confidentiality was maintained throughout the study as the names of parents were not collected and a system of code numbers was used instead.

Number of participants invited -380

Number of completed questionnaire received – 117 (Response rate-31%)

Number of incomplete questionnaire - 4

Number of participants asked for the summary of results - 25

## **6. Analysis Plan**

The obtained data was transferred to spread sheet in order to secure the data. Spreadsheet was used for data analysis. Statistical package for the Social Sciences (SPSS-18) was used for analysing and interpreting the data obtained in this study.

### **6.1 Data Pre-processing**

The data was pre-processed to insure a quality check before running an analysis. This involved verifying any “missing data” and “outliers”. Four incomplete questionnaires have been found. These were missing the answer on the “gross weekly income”. These questionnaires were included in the data analysis procedures and grouped under participants who selected the option “don’t know “for the question “gross weekly income”.

### **6.2 Analysis**

Two stages of analysis were carried out:

- Descriptive analysis
- Inferential analysis

In the descriptive analysis, frequency distributions for socio demographic variables, actual responses for each question, mode, median and standard deviation for the total scores were identified.

In inferential analysis, the association of oral health literacy scores with socio-demographic variables and parents’ attitude towards water fluoridation were identified using bivariate and multivariate analysis.

### **6.3 Calculation of scores**

For the categorical analysis, we used tertiles to divide the score of oral health knowledge, comprehension knowledge and oral health literacy in three ordered distributions based on the past studies. These categories are used only for categorical analysis (cross-tabulation) and for further analysis such as T-test and regression analysis, the raw health literacy scores were used to avoid any missing information.

#### **Health Knowledge scores**

Based on the previous studies, scores were categorised into three categories namely Poor (1-10), Moderate (11-14) and Good (15-18).

#### **Comprehension knowledge scores**

The scores were dichotomized into two categories namely poor (1-4) and good (all correct answers for 5 questions).

#### **Oral Health literacy scores**

Three categories were formed from the total score, namely Poor (1-16), Moderate (17-19) and Good (20-23)

Now results obtained in the analysis will be discussed in the results chapter.

## **Chapter Four: Results**

This study is intended to investigate the level of oral health literacy among New Zealand parents. The level of oral health literacy was measured by assessing oral health and comprehension knowledge. Another important objective of this study was the association of parents' attitudes towards water fluoridation in Christchurch with their level of oral health literacy. The purpose of the study was achieved by examining the level of parents' oral health literacy and its association with other socio-economic factors. This chapter presents the results of the data analysis of the five stated research questions.

The first part of the result section included the reliability and validity assessment of the questionnaire. The reliability test was presented separately for the questions taken from Ludke et al.'s (Personal communication, 2010) questionnaire and also for the complete questionnaire used for our survey.

The results chapter encompasses two sections including descriptive results to establish the following: the total scores obtained in the oral health knowledge test, and in the comprehension knowledge test, the level of oral health literacy, the association of various socio-demographic variables with overall oral health literacy, the frequency of variables for all survey questions and the responses given by the participants.

The second part of the results chapter consists of additional analyses of the data. In further analysis, association between the socio-demographic factors and health literacy was obtained by bivariate and multivariate analysis.

## **1. Reliability and Validation Assessment of the Oral health Literacy Questionnaire**

The reliability test was presented separately for the questions taken from Ludke et al.'s (2010) questionnaire and also for the complete questionnaire used for our survey. The internal consistency and unidimensionality of the questionnaire was determined by using the same test used by Ludke, et al. (2010) to compare the results of current study with their study.

### **1.1 Internal Consistency of the Oral Health Literacy Questionnaire**

The internal consistency reliability of the developed questionnaire was determined using Cronbach's alpha test, the inter-item correlation test and the Spearman-Brown coefficient.

The Cronbach's alpha was tested separately for the oral health knowledge questions (Q1-Q19) and for the comprehension test questions (Q20-Q24). The Cronbach's alpha for Q1-Q12 was also used to compare the values of Ludke's (2010) validation report.

The Cronbach's alpha for Q1-Q12 is 0.645 which is slightly less than Ludke's value (0.666). The Cronbach's alpha for the questions Q20-Q24 is 0.427 which is low due to fewer questions in the group. The Cronbach's alpha for our knowledge questionnaire was higher (0.682) (See Table 3).

Table 3

*Internal Consistency Reliability*

Items	Q1-Q12	Q20-Q24	Q1-Q19	Q1-Q24
Cronbach's Alpha	0.645	0.427	0.682	0.691
Ave Inter-Item Correlation	0.091	0.168	0.116	0.296
Ave- Spearman-Brown Coefficient	0.680	0.502	0.700	0.704

The Cronbach's alpha values for the questionnaire increased on adding each section of the questionnaire, which indicates that the items could be related to each other. The highest Cronbach's alpha value (0.691) for the complete questionnaire explains the high internal reliability of the questionnaire.

Cronbach's value for instruments such as OHLI (0.898), CMOHK (0.74), REALD-30 (0.87), and REALD-99 (0.84) were higher than our instrument and this was due to the increased number of questions in the questionnaires. The Cronbach's alpha value increases as the number of items in the scale increases (Garson, 2010). By convention, a lenient cut-off of 0.60 is common in exploratory studies such as current study (Garson, 2010). Cronbach's alpha value of 0.691 was slightly lower than the standard "adequate scale" (0.7) which explains the good internal consistency of the questionnaire (Garson, 2010). The Cronbach's alpha value can be increased by adding a few items to the questionnaire.

The internal consistency of the questionnaire was also tested using the inter item correlation test and the Spearman-Brown coefficient test (see Table 3).

The average inter-item correlation for the health knowledge test is 0.116 and for the comprehension test is 0.168. The values of the average inter-item correlation was lower than 0.7, which is due to one or more item correlated at a much lower degree (negative correlation) than the remaining items in the questionnaire. The lower inter-item correlation indicates that degree of difficulty between the items in the questionnaire. For example, the difficulty in answering Question 13 about the concentration of fluoride in a child's toothpaste was higher compared to Question 1 (A cavity is\_\_\_\_\_). This explains that the internal consistency of the questionnaire was low. This problem might be rectified by removing the easiest questions from the questionnaire which are questions to which the majority of the participants (> 90%) gave correct answers.

The Spearman-Brown coefficient is also called the Spearman-Brown stepped-up reliability coefficient. This is calculated from the standardised item alpha and the average of inter-item correlations. The average Spearman-Brown coefficients for the knowledge test and the comprehension test were 0.700 and 0.502 respectively. The average Spearman-Brown stepped-up reliability coefficient values are used to estimate the change in reliability as the number of items in an instrument varies. The different values of the Spearman-Brown coefficient for sets (Q1-Q12, Q1-Q19), Q20-Q24) show the presence of dissimilarity of variances among items in the sets.

## **1.2 Unidimensionality**

The unidimensionality was tested using inter-item correlations and corrected item-total correlations (See Table 4). The unidimensionality was tested individually for the knowledge



test and the comprehension test by creating a correlation matrix for all the questions in the each set.

### **Inter-item correlations**

Inter-item correlation was performed for actual response given by the parents before correcting the questions into correct and incorrect response. Complete analysis of the correlation matrix indicates that no item in the questionnaire had a correlation  $< 0.15$  on correlating with other items in the questionnaire, which suggests that the questionnaire has unidimensionality.

The unidimensionality of a questionnaire will be increased by developing a questionnaire which has a 5-point Likert scale response. Respondents scale scores will be obtained by adding their scores for each item. This method will increase the unidimensionality by decreasing the occurrence of negative correlation between the items due to a uniform ranking pattern.

### **Corrected- item total correlations**

Corrected item- total correlation was measured by dichotomizing the responses into either a correct or wrong answer. The psychometric analysis of corrected item-total correlation was performed to check how well a question differentiates between participants who know the material and those who do not. After correcting the answers, the values of discrimination found between all questions were  $\geq 0.40$  which represents a good discrimination between all questions (See Table 4).

Table 4

*Unidimensionality*

Items	Q1-Q12	Q20-Q24	Q1-Q19
Inter-Item	32.30% Between	60.0% Between	37.65% Between
Correlations	0.15 and 0.50.	0.15 and 0.50.	0.15 and 0.50.
	Highest= 0.544.	Highest=0.658.	Highest=0.562.
	No Item with all	No Item with All	No Item with All
	Correlation< 0.15	Correlation< 0.15	Correlation< 0.15.
Corrected Item- Total Correlations	No items with Correlation $\geq 0.40$	No items with Correlation $\geq 0.40$	No items with Correlation $\geq 0.40$

There was no item with correlations  $\geq 0.04$  which indicates that after coding the item into correct and wrong response, the unidimensionality was improved. This indicates that the questions in the questionnaire differentiated between participants who knew the material and those who did not. The value of item-total correlation indicates that the developed questionnaire had good discrimination validity. This represents that those participants who did not have oral health knowledge scored low on individual questions and had lower overall assessment scores. According to the point-biserial standard, values for an item-total correlation between 0 and 0.19 may indicate that the question is not discriminating well, values between 0.2 and 0.39 indicate good discrimination, and values 0.4 and above indicate very good discrimination (Pope, 2009). Hence, the values for item-total correlation  $\geq 0.4$  obtained in the present study evaluated the good performance of the questions.

Table 5

*Internal Consistency of Current Study and Ludke, et al's(2010) study*

Items	Ludke et al.'s result		Current study result	
	A1-A2	B1-B5	Q1-Q12	Q20-Q24
Cronbach's alpha test	0.666	0.404	0.645	0.427
Ave-Inter-item Correlation	0.161	0.051	0.091	0.168
Ave- Spearman- Brown Coefficient	0.633	0.402	0.680	0.502

Table 6

*Unidimensionality of the Current Study and Ludke, et al.'s Study*

Items	Ludke et al.'s result		Current study result	
	A1-A2	B1-B5	Q1-Q12	Q20-Q24
<b>Inter-item correlations</b>				
Percentage between 0.15&0.50	40.9	40.0	32.3	60.0
Highest	0.344	0.315	0.544	0.658
<b>Corrected item-total correlations</b>	*	*	*	*

\* No item with correlation  $\leq 0.40$

The comparative analysis of validation report results between Ludke's (2010) questionnaire and our questionnaire indicates that both results were same. This indicates that first two sections that we used from Ludke's questionnaire had good external validity (see Tables 5 and 6).

## **2. Descriptive Analysis**

### **2.1 Distribution of Socio-Demographic Variables**

Participants aged between 30-39 years were highly represented in the survey (about 57.3% (n=67) of the total sample). The age groups below 30 years and above 40 years were equally distributed and there were approximately 20 % in each. Participants aged above 50 years were low. This is not surprising, given the sample was drawn from parents with children attending a pre-school centre in Christchurch.

The majority of the participants were female (79.5%) and only 20.5% of population were male. Sixty one percent of participants had a university education, the highest obtained education level and 35% had high school education or below.

The majority of participants (65%) identified as New Zealand European. The number of participants that identified as being of Maori, Samoan and Indian ethnicity was equally distributed (about 4.3% in each). A significant number of participants (22.2%) were from other ethnic groups namely Pilipino, Romanian, Chinese, European (UK) and Sri Lankan.

The number of participants working other than health and education sectors was high at 61.5%. A significant number of participants reported working in the education sector (17%).

The percentage of people working in the health sector and participants who were not employed was 7.7% and 13.7% respectively.

The majority of participants reported being the child's mother (76%) and only 20.5% were the child's father who answered the questionnaire. The weekly family income for the participants was grouped under four categories: less than \$500 (16.2%), \$500-\$1000 (32.5%), 1000-1500 (22.2%) and greater than 1500 (20.5%). This appears to be equally distributed and participants' weekly family income of between \$500 and \$1000 was slightly higher compared to other categories used. Table 7 describes the socio-demographic details of the study sample.

Table 7

*Socio-Demographic variables of Total Sample*

Variables	Count (n=117)	Percentage
Age in Years		
Less than 30	24	20.5
30 to 39	67	57.3
40-49	23	19.7
Greater than 50	3	2.6
Gender		
Men	24	20.5
Women	93	79.5
Education		
High School or Lower	41	35.1
University Education	71	60.7
Ethnicity		
NZ European	76	65.0
Maori	5	4.3
Samoan	5	4.3
Others	26	22.2
Employment		
Working in Health	9	7.7
Working in Education	20	17.1
Working in Other Sector	72	61.5
Unemployed	16	13.7
Relationship with child		
Mother	89	76.1
Father	24	20.5
Family Income Per Week		
Less than 500	19	16.2
5 00-1000	38	32.5
1000-1500	26	22.2
>1500	24	20.5

## 2.2 Participants' Response Variables

Appendix I illustrate the frequency distribution of every question in the questionnaire in the actual response order that the question occurred in the questionnaire.

The response given by each participant was identified using a frequency analysis. The frequency distribution for each question is reported in the Appendix I. More than 80% of participants provided the correct answer for question number.

- 1. Cavity is\_\_\_\_\_ (96.6%)
- 2. The amount of fluoride tooth paste used for a child of 2 years or older is\_\_\_\_\_ (87.2%)
- 4. Plaque is\_\_\_\_\_ (83.8%)
- 6. Enamel is\_\_\_\_\_ (90.6%)
- 9. Putting a child to bed with a bottle of milk\_\_\_\_\_ (80.3%)
- 11. Giving children sugary snacks between meals\_\_\_\_ (89.7%)and
- 16. Generally, the first teeth appear in the mouth\_\_\_\_\_(80.3%).

The majority of participants gave incorrect responses to:

- 3. Cleaning baby's gum after feeding\_\_\_\_ (46.2%)
- 8. Parents should brush their child's teeth until\_\_\_\_ (36.8%)
- 13. The best fluoride toothpaste for your child\_\_\_\_ (19.7%)
- 17. The delayed eruption of teeth may be due to\_\_\_\_(17.9%).

For the rest of the questions, correct and incorrect responses were equally distributed.

Nearly 90% of participants correctly answered 20 to 24 of the comprehension knowledge test questions. In terms of the fluoridation question, 56.4% of participants answered “Yes” for fluoridating the Christchurch water supply and 43.6% of participants said “No”. Just over half the respondents believed the Christchurch water supply should be fluoridated.

### **2.3 Distribution of Health Knowledge and Comprehension Test Score**

As discussed in the methods chapter, scores were calculated separately for the health knowledge and the comprehension knowledge test in order to carry out the categorical analysis. The mean raw health knowledge score was 12.21 (SD=2.908). The mean raw comprehension score was 4.650 (SD=0.699). The histogram (see Fig 5) with a standard curve shows a high distribution of scores between 12 and 15. The majority of participants (74.4%) obtained 5 for the comprehension knowledge test which was the highest score (see figure 6).

The modified health knowledge score (see Table 10) was equally distributed between the categories of poor and good and nearly half of the participants (51%) had moderate health knowledge. The modified comprehension score (see Table 11) was divided into two categories namely correct and incorrect responses. Three quarters of the participants (74.4%) gave correct answers for all questions in the comprehension test. The comparison of oral health knowledge scores and comprehension scores (see figure 7) indicates that both are least consistent with each other with the Spearman rho' correlation value of 0.233 ( $p=0.01$ ) (see Table 8).

The calculated health literacy scores (see Table 12) indicate that the highest number of participants (41.0) were categorised as having a moderate health literacy score. In the total population, 37.6% and 21.4% of participants were categorised under poor and good oral



health literacy. The raw health literacy scores were much more normally distributed, having a slight negative skew, a median of 17, a mean of 16.85 and a standard deviation of 3.14 (see Figure 8).

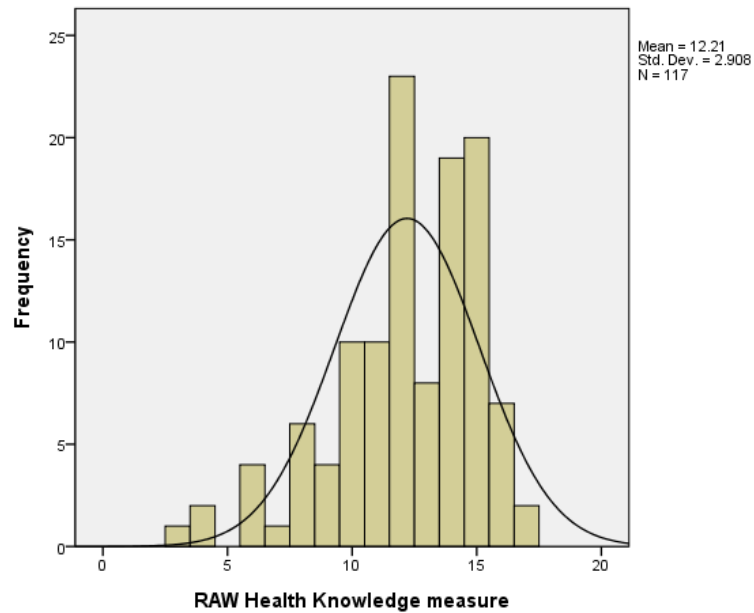


Figure 5 *Distribution of Raw Health Knowledge Scores*

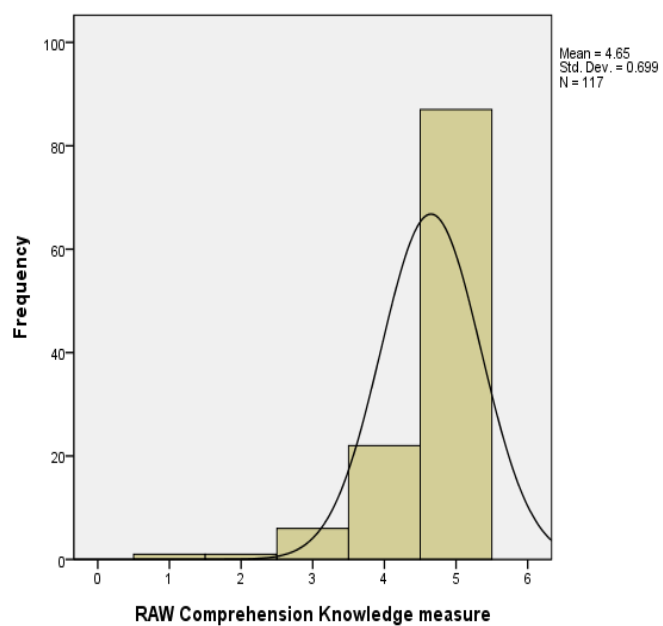


Figure 6

*Distribution of Raw Comprehension Knowledge Score*

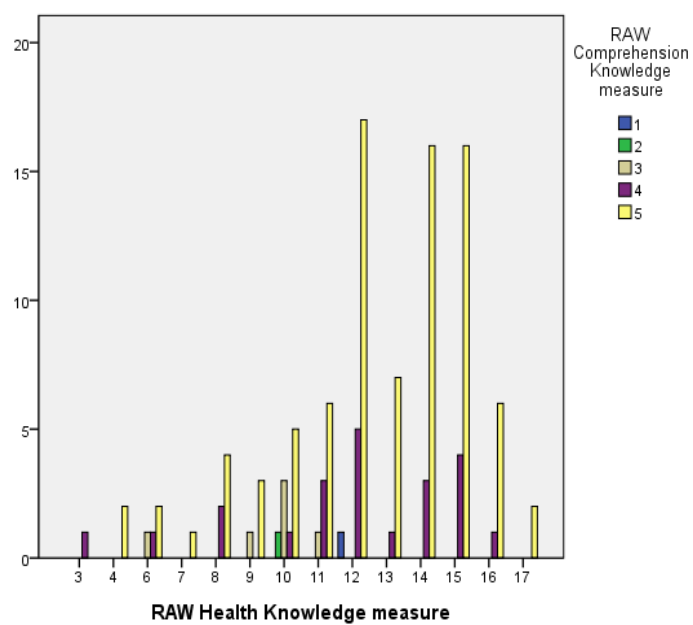


Figure 7

*Comparison of scores of oral Health Knowledge and Comprehension Test*

Table 8

*Comparison of Oral Health Knowledge and Comprehension Knowledge Score*

	Spearman rho's correlation	p
Oral health knowledge	0.233	0.011*
Comprehension knowledge	0.233	0.011*

\*Significant at  $p < 0.05$

Table 9

*Descriptive Statistics for Health Knowledge and Comprehension Knowledge Total Score*

Variables	n	Mean	Standard Deviation
Health Knowledge	117	12.21	2.908
Comprehension	117	4.650	0.699
Health literacy	117	16.85	3.136

Table 10

*Frequency of Health Knowledge Score*

Health Knowledge	Modified Score	Count	Percent
Inadequate	1-10 (1)	28	23.90
Moderate	11-14 (2)	60	51.30
Adequate	15-18 (3)	29	24.80

Table 11

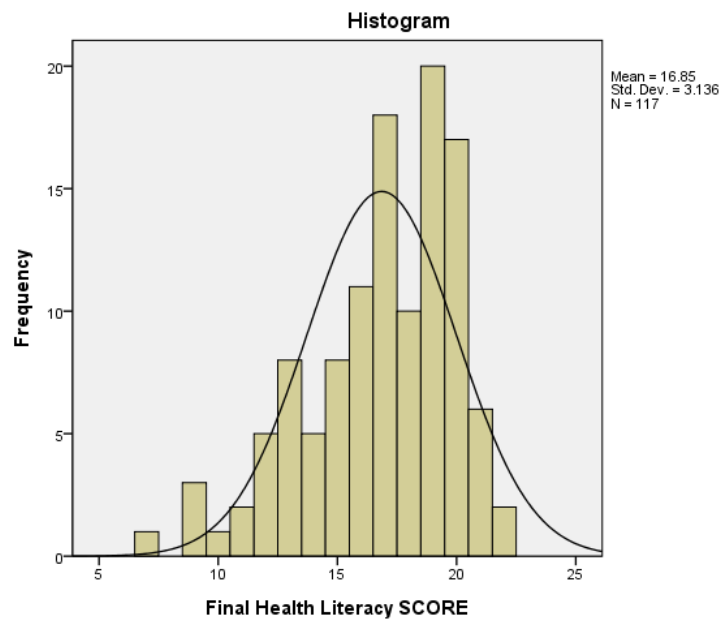
*Frequency of Comprehension Knowledge Score*

Comprehension Test	Modified Score	Count	Percent
Incorrect	0	30	25.60
Correct	1	87	74.40

Table 12

*Frequency of Oral Health Literacy scores in three categories*

Health Literacy	Modified Score	Count	Percent
Inadequate	1-16	44	37.6
Moderate	17-19	48	41.0
Adequate	20-23	25	21.4



*Figure 8*  
*Distribution of Raw Health Literacy Score*

### 3. Bivariate Analysis

#### 3.1 Parents' Attitude towards Water Fluoridation and Oral Health Literacy

Figure 9 illustrates the results of cross tabulation between raw health literacy scores and the attitude of parents towards fluoridating Christchurch water. This demonstrates that more participants with a lower health literacy score said “No” to fluoridating the water supply in Christchurch. The majority of participants with health literacy scores of 16 and above said “Yes” compared to “No” for fluoridating the water supply in Christchurch. All the participants with the lowest health literacy score of seven said “No” to fluoridating the water supply. Also all participants with the highest score of twenty two said “Yes” to fluoridate the water supply in Christchurch.

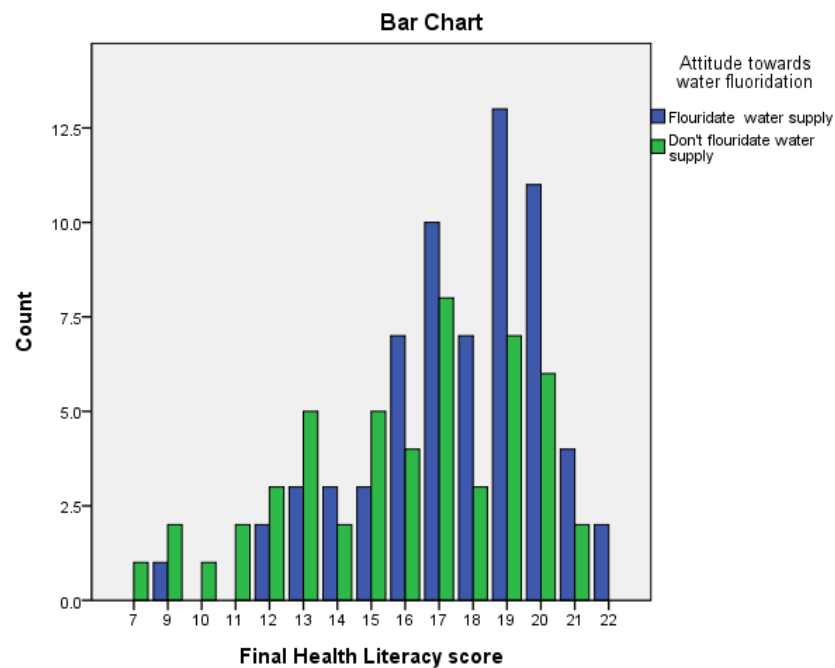


Figure 9

*Association of Raw Health Literacy Score and Attitude towards water Fluoridation*

### 3.1.1 T-test for Oral Health Literacy and Parents' Attitude towards Water Fluoridation

The T test was performed to test the difference between the independent groups ("Yes" and "No" responses) on the mean of oral health literacy (continuous variable). Table 13 illustrates the descriptive statistics of the variables included in the t-test. The p value for the Levene's (see Table14) test for equality of variance was significant ( $P=0.025$ ). Therefore, the equal variance not assumed test was used to interpret the results. The results of the T-test show that parents' attitudes towards Christchurch's water fluoridation and raw health literacy scores were statistically associated ( $t=3.021$ ,  $df=91.101$ ;  $p=.004$ ).

Table 13

#### *T-test Group Statistics*

Water Fluoridation	N	Mean	Std deviation	Std error
Yes	66	17.61	2.648	0.326
No	51	15.88	3.462	0.485

Table 14  
*Independent T test*

	Levene's test of Equality of variances		t-test for Equality of means						
	F	Sig	t	df	p	mean diff	std error diff	95% confidence Interval of diff	
								Lower	upper
Equal variance assumed	5.133	.025	3.052	115	.003*	1.724	.565	.605	2.842
Equal Variance Not assumed			2.951	91.101	.004*	1.724	.584	.563	2.884

\*Significant at  $p < 0.005$

### 3.1.2 Comparison of Parents' Knowledge and Attitude towards Water Fluoridation

Figure 10 and Table 15 represent the result of cross-tabulating the response of parents' knowledge of water fluoridation and parents' attitudes towards water fluoridation. The results denote that the majority of parents with good knowledge of water fluoridation opted for water fluoridation in Christchurch. Among parents who reported "Yes" for water fluoridation, 87.9% had good knowledge of water fluoridation. At the same time, 45.1% of parents who responded "No" to water fluoridation had poor oral health knowledge. A significant chi-square value (16.604,  $p < 0.001$ ) represents the fitness of the above results.



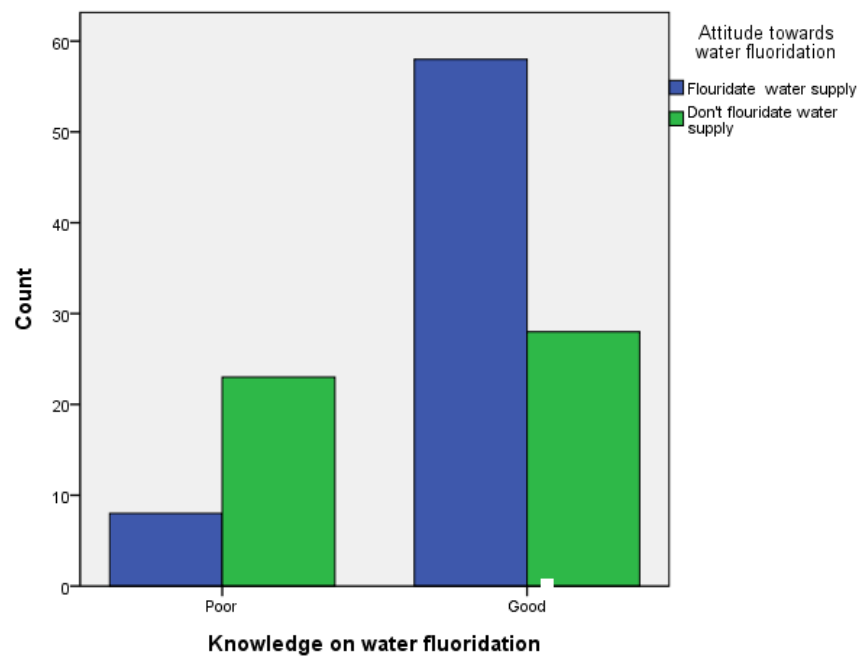


Figure 10

*Comparison of Parents' Knowledge and attitude regarding water fluoridation*

Table 15

*Cross tabulation between Parents' Knowledge and Attitude about Water fluoridation*

Water Fluoridation- attitude	Water fluoridation-Knowledge				Chi-square	p
	Poor		Good			
	n	%	n	%		
					16.064	0.000
Fluoridate water supply	8	(12.1)	58	(87.9)		
Don't fluoridate water supply	23	(45.1)	28	(54.9)		

\*Significant at  $p < 0.001$

### 3.2 Parent's Knowledge on System Navigation

Parents' knowledge of system navigation was correlated with socio-demographic variables (income and ethnicity) and oral health literacy. Figure 11 indicates that oral health literacy scores are associated with the parents' knowledge of system navigation. The significant high chi-square value (51.129,  $p < 0.001$ ) denotes that parents' knowledge of system navigation is strongly associated with parents' oral health literacy.

Figures 12 and 13 denote the results of cross-tabulation of parents' knowledge of system navigation with income and ethnicity. The chi-square value (see table 16) (18.144,  $p = 0.003$ ) for ethnicity was high and indicate that ethnicity is associated with knowledge of system navigation. The result for income was not significant.

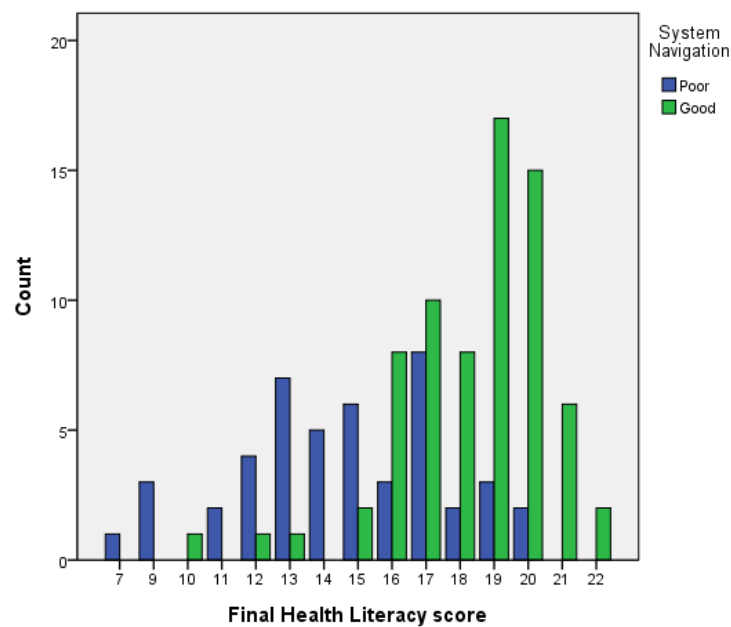


Figure 11

*Association between Parents' Knowledge on System Navigation and Oral Health Literacy*

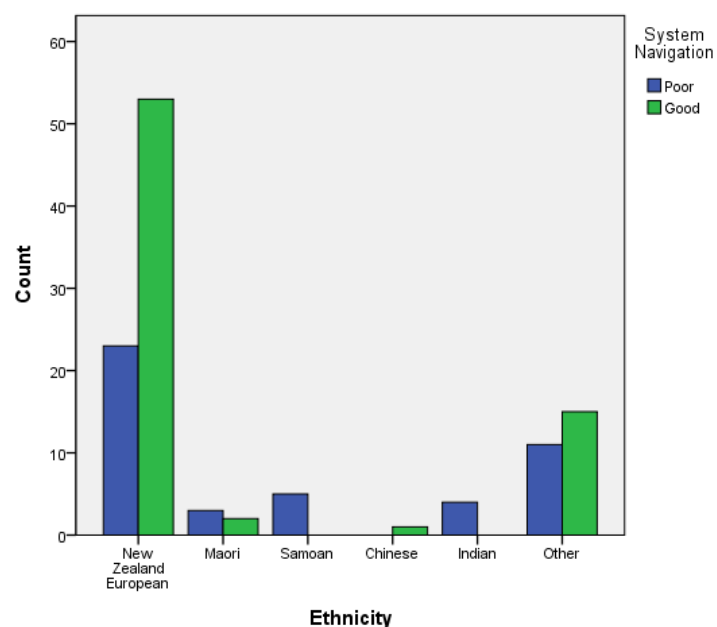


Figure 12

*Association between Parents' Knowledge on System navigation and Ethnicity*

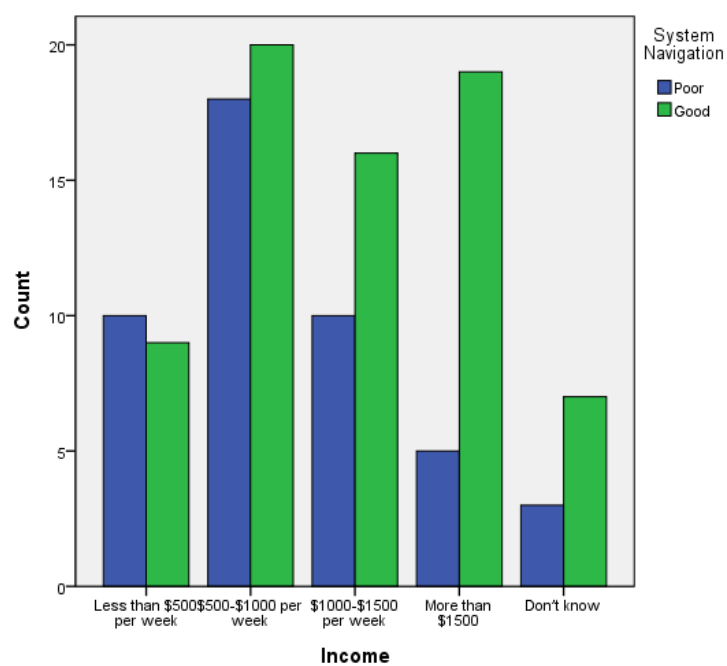


Figure 13

*Association between Parents' Knowledge on System Navigation and Income*

Table 16

*Chi-Square Results*

	Chi-square	Significance
Oral health literacy	51.129	0.000 *
Ethnicity	18.144	0.003**
Income	6.253	0.180

\*Significant at  $p < 0.001$

\*\*Significant at  $p < 0.01$

A single way cross tabulation was performed separately for categories of oral health literacy, oral health knowledge and comprehension knowledge with socio-demographic variables. The results are presented in Table 17, 18 and 19.

### 3.3 Oral Health Literacy and Socio-Demographic Variables

A single way cross tabulation (See Table 17) between modified health literacy and socio-demographic factors gives the nominal level data under different categories of age; gender; education level; ethnicity; employment; relationship with the child, and gross family income. The majority of participants (54.2%,  $n=13$ ) who were under 30 years had poor oral health literacy. The number of participants under 30 years in the total population was 24. The majority of participants (65.2%) of age 40 and above had “moderate oral health literacy”. The participants aged between 30 and 39 who had poor, moderate and good health literacy was distributed equally in all the three categories.

A high proportion (54.2%,  $n=13$ ) of male participants had poor oral health literacy compared to moderate and good categories. The female participants were highly represented in (44.1%)

the category “moderate oral health literacy”. In the total male population only 16.7% had good oral health literacy compared to 22.6% in the total female population.

The majority of participants who completed a university education had moderate (49.3%, n=35) and good (21.1%, n=15) oral health literacy. The majority of parents (55%, n=22) with the highest attained qualification as high school had low levels of oral health literacy. An association between education level and oral health literacy was found,  $X^2$  (df, N=117) =14.386, P=0.026)

The majority of participants were from the New Zealand European ethnic group (n=76). From that group 27.6%, 46.1% and 26.3% of participants had poor, moderate and good levels of oral health literacy respectively. There were only a few participants from the Maori, Indian and Samoan ethnic groups and of that 60%% (n=3), 100% (n=4) and 100% (n=5) of participants had poor oral health literacy levels. Only 19.2% percentage of participants from other ethnic groups had good oral health literacy. Oral health literacy was associated with ethnicity ( $X^2$  (df, N=117) =21.706, P=0.017).

Compared to mothers, fathers had lower levels of health literacy. More than a half (54.4%) of the fathers had poor oral health literacy. The cross tabulation between income and oral health literacy scores was statistically significant( $X^2$  (df, N=117) =26.841, P=0.001). There were two parents (8%, n=2) with more than \$1500 as the weekly family income represented under poor oral health literacy. At the same time, parents with less than \$500 as the gross weekly family income were not represented under the good oral health literacy category.

The chi-square values for income ( $X^2$ = 26.841, P=0.001), ethnicity ( $X^2$ =21.706, p=0.017) and education ( $X^2$ = 14.386, p=.026) were high which proves the extreme association of health literacy with education, income and ethnicity. The chi-square values for all other demographic values were higher than zero. This shows that there were some associations persisting between socio-demographic factors (gender, income and education) and health literacy.

Table 17

*Cross Tabulation between Oral Health Literacy and Socio-Demographic Variables*

Socio-Demographic Factors	Poor		Moderate		Good		Chi- Square (p)	
	n	(%)	n	(%)	n	(%)	X <sup>2</sup>	(p)
Age in Years							11.949	(.063)
Less than 30	13	(54.2)	7	(29.2)	4	(16.7)		
30-39 years	23	(34.3)	25	(37.3)	19	(28.4)		
40 -49 years	6	(26.1)	15	(65.2)	2	(8.7)		
50 & above	2	(66.7)	1	(33.3)	0	-		
Gender							3.549	(.170)
Female	31	(33.3)	41	(44.1)	21	(22.6)		
Male	13	(54.2)	7	(29.2)	4	(16.7)		
Education							<b>14.386</b>	<b>(.026)*</b>
University	21	(29.6)	35	(49.3)	15	(21.1)		
High School	22	(55.0)	9	(22.5)	9	(22.5)		
<High School	1	(20.0)	4	(60.0)	1	(20.0)		
Ethnicity							<b>21.706</b>	<b>(.017)*</b>
NZ European	21	(27.6)	35	(46.1)	20	(26.3)		
Maori	3	(60.0)	2	(40.1)	0	-		
Samoan	5	(100.0)	-	0	0	-		
Indian	4	(100.0)	0	0	0	-		
Chinese	0	0	1	(100.0)	0	-		
Others	11	(42.3)	10	(38.5)	5	(19.2)		
Employment							3.109	(.795)
Working in Health	5	(31.3)	7	(43.8)	4	(25.0)		
In education	10	(47.6)	8	(38.1)	3	(14.3)		
Other sectors	21	(32.8)	28	(43.8)	15	(23.4)		
Unemployment	8	(50.0)	5	(31.3)	3	(18.8)		
Relationship with the Child							7.439	(.490)
Mother	29	(32.6)	39	(43.8)	21	(23.6)		
Father	13	(54.2)	7	(29.2)	4	(16.7)		
Others	2	(50.0)	2	(50.0)	0	-		
Family Income per Week							<b>26.841</b>	<b>(.001)*</b>
Less than 500	15	(32.6)	4	(21.1)	0	0		
500-1000	17	(38.6)	15	(39.5)	6	(15.8)		
1000-1500	7	(26.9)	11	(42.3)	8	(30.8)		
>1500	2	(8.3)	14	(58.3)	8	(33.3)		
Don't know	3	(30.0)	4	(40.0)	3	(30.0)		

\*Statistically significant X<sup>2</sup> results.

### **3.4 Oral Health Knowledge and Socio-Demographic Variables**

Table 18 illustrates the results of cross-tabulation of socio demographic variables with oral health knowledge. The result suggests that oral health knowledge was associated with demographic variables such as age, education, ethnicity and income with statistically significant results.

The chi-square values of age ( $X^2=12.601$ ,  $p=0.050$ ), education ( $X^2=20.543$ ,  $p=0.002$ ), ethnicity ( $X^2=29.080$ ,  $p=0.001$ ) and income ( $X^2=30.360$ ,  $p=0.000$ ) represent that the association was strong. The results indicate that variables such as gender, employment and relationship with the child were not associated with oral health knowledge.

Table 18

*Cross Tabulation between Health Knowledge and Socio-Demographic variables*

Socio-Demographic Factors	Poor		Moderate		Good		Chi-Square(p)	
	n	(%)	n	(%)	n	(%)	X <sup>2</sup>	(p)
<b>Age in Years</b>							<b>12.601*</b>	(.050)
Less than 30	9	(37.5)	10	(41.7)	5	(20.8)		
30-39 years	15	(22.4)	30	(44.8)	22	(32.8)		
40 -49 years	3	(13.0)	18	(78.3)	2	(8.7)		
50 & above	1	(33.3)	2	(66.7)	0	-		
<b>Gender</b>							3.301	(.192)
Female	19	(20.4)	49	(52.7)	25	(26.9)		
Male	9	(37.5)	11	(45.8)	4	(16.7)		
<b>Education</b>							<b>20.543*</b>	(.002)
University	9	(12.7)	43	(60.6)	19	(26.8)		
High School	18	(45.0)	13	(32.5)	9	(22.5)		
<High School	1	(20.0)	4	(60.0)	1	(20.0)		
<b>Ethnicity</b>							<b>29.080*</b>	(.001)
NZ European	13	(17.1)	41	(53.9)	22	(28.9)		
Maori	1	(20.0)	4	(80.0)	0	-		
Samoan	5	(100.0)	0	-	0	-		
Indian	3	(75.0)	1	(25.0)	0	-		
Chinese	0	0	0	-	1	(100.0)		
Others	6	(23.1)	14	(53.8)	6	(23.1)		
<b>Employment</b>							3.246	(.777)
Working in Health	3	(18.8)	9	(56.3)	4	(25.0)		
In education	4	(19.0)	13	(61.9)	4	(19.0)		
Other sectors	15	(23.4)	31	(48.4)	18	(28.1)		
Unemployment	6	(37.5)	7	(43.8)	3	(18.8)		
<b>Relationship with the Child</b>							7.631	(.470)
Mother	18	(20.2)	46	(51.7)	25	(28.1)		
Father	8	(33.3)	12	(50.0)	4	(16.7)		
Others	2	(50.0)	2	(50.0)	0	-		
<b>Family Income per Week</b>							<b>30.360*</b>	(.000)
Less than 500	12	(63.2)	7	(36.8)	0	0		
500-1000	11	(28.9)	20	(52.6)	7	(18.4)		
1000-1500	3	(11.5)	14	(53.8)	9	(34.6)		
>1500	0	-	14	(53.8)	10	(41.7)		
Don't know	2	(20.0)	5	(50.0)	3	(30.0)		

\*Statistically significant X<sup>2</sup> results.



### **3.5 Comprehension Knowledge and Socio-Demographic Variables**

Table 19 illustrates the results of cross tabulation between comprehension knowledge categories and socio-demographic variables. The results indicate that comprehension skill is not associated with socio-demographic variables such as age, education, ethnicity, employment and relationship with the child.

The result denotes that there was a strong association present with gender and income with statistically significant results. The chi-square values of gender ( $X^2=0.937$ ,  $p=0.033$ ), income ( $X^2=11.246$ ,  $p=0.024$ ), indicate that income is a stronger predictor than gender with high chi-square value.

Table 19

*Cross Tabulation between Comprehension Knowledge and Socio-Demographic variables*

Socio-Demographic Factors	Poor		Good		Chi-Square(p)	
	n	(%)	n	(%)	X <sup>2</sup>	(p)
<b>Age in Years</b>					1.123	(.771)
Less than 30	7	(29.2)	17	(70.8)		
30-39 years	18	(26.9)	49	(73.1)		
40-49 years	4	(17.4)	19	(82.6)		
50 and above	1	(33.3)	2	(66.7)		
<b>Gender</b>					<b>0.937*</b>	<b>(.033)</b>
Female	22	(23.7)	71	(76.3)		
Male	8	(33.3)	16	(66.7)		
<b>Education</b>					5.970	(.113)
University	16	(22.5)	55	(77.5)		
High School	13	(32.5)	27	(67.5)		
< High school	1	(16.6)	5	(83.4)		
<b>Ethnicity</b>					4.311	(.506)
NZ European	17	(22.4)	59	(77.6)		
Maori	2	(40.0)	3	(60.0)		
Samoan	1	(20.0)	4	(80.0)		
Indian	1	(25.0)	3	(75.0)		
Chinese	1	(100)	0	-		
Others	8	(30.8)	18	(69.2)		
<b>Employment</b>					1.754	(.625)
Working in Health	4	(25.0)	2	(75.0)		
In education	6	(28.6)	15	(71.4)		
Other sectors	18	(28.1)	46	(71.9)		
Unemployment	2	(12.5)	14	(87.5)		
<b>Relationship with the Child</b>					2.164	(.706)
Mother	22	(24.7)	67	(75.3)		
Father	8	(33.3)	16	(66.7)		
Others	0	-	4	(100.0)		
<b>Family Income per Week</b>					<b>11.246*</b>	<b>(.024)*</b>
Less than 500	7	(36.8)	12	(63.2)		
500-1000	15	(39.5)	23	(60.5)		
1000-1500	5	(19.2)	21	(80.8)		
>1500	3	(12.5)	21	(87.5)		
Don't know	0	-	10	(100.0)		

\*Statistically significant X<sup>2</sup> results.

#### **4. Multivariate Analysis:**

Multiple linear regression analysis was undertaken by creating dummy variables for all the socio-demographic variables. Two models were developed for the regression analysis. In the first model the oral health literacy (dependent variable) was regressed with socio-demographic variables and in the second model parents' attitudes towards water fluoridation were added to the first model.

Table 20 illustrates the regression results for model I and model II. The Tables 21, 22, 23 and 24 illustrate the model summary for the developed models. R square value and the results of ANOVA table describe the goodness of fit for the developed model. The F statistic is the regression mean square divided by the residual mean square. The significant value for F statistic ( $p < .001$ ) denotes that the independent variables explain the variation in the dependent variable (health literacy).

Table 20

*Multiple Linear Regression Results*

Predictor variables	Model I		Model II	
	$\beta$	SE	$\beta$	SE
<b>Constant</b>	<b>15.542***</b>	2.895	<b>17.327***</b>	2.922
<b>Age in Years</b>				
Less than 30	1.422	0.848	1.573	0.830
30-39 years	0.447	0.647	0.733	0.643
40 and above	0	0	0	0
<b>Gender</b>				
Female	0	0	0	0
Male	-2.366	1.093	<b>-1.905*</b>	1.084
<b>Education</b>				
University	1.266	1.080	1.131	1.055
High School	<b>-0.269</b>	1.095	-.229	1.069
Others	0	0	0	0
<b>Ethnicity</b>				
NZ European	<b>1.570**</b>	0.598	<b>1.901*</b>	0.599
Chinese	4.206	2.546	3.911	2.488
Maori	-0.479	1.215	-.206	1.191
Samoan	<b>-3.143*</b>	1.293	<b>-2.456*</b>	1.294
Indian	<b>-4.226*</b>	1.408	<b>-3.318*</b>	1.425
Others	0	0		
<b>Employment</b>				
Working in Health	0.157	0.852	0.384	0.837
In education	<b>-1.679*</b>	0.728	<b>-1.494*</b>	0.715
Other sectors	0	0	0	0
Unemployment	-0.461	.739	-0.148	0.733
<b>Relationship</b>				
Mother	1.110	2.694	0.625	2.637
Father	2.690	2.908	1.974	2.853
Child's step father	0.922	3.087	0.554	3.016
Child's Foster parent	-0.559	3.742	-1.404	3.669
Grand parents	0	0	0	0
<b>Family Income</b>				
Less than 500	<b>-3.561***</b>	1.069	<b>-3.843***</b>	1.050
500-1000	<b>-1.892</b>	0.962	<b>-2.042*</b>	0.941
1000-1500	-0.283	1.000	-0.457	0.979
>1500	-0.042	1.042	-0.074	1.018
Don't know	0	0	0	0
<b>Water Fluoridation</b>	0	0	<b>-1.192*</b>	0.497

Model: I forcing socio-demographic variables

Model: II adding attitude towards water fluoridation in Model 1

 $\beta$ , regression coefficient: SE, Standard error, \* Significant at  $P < .05$ , \*\* Significant at  $P < .01$ ,\*\*\* Significant at  $P < .001$

Table 21

*ANOVA Table for Regression Model- I*

ANOVA <sup>b</sup>					
Model	Sum of Squares	df	Mean Square	F	Sig
1					
Regression	594.667	21	28.317	4.928	.000 <sup>a</sup>
Residual	545.863	95	5.746		
Total	1140.530	116			

Table 22

*Model Summary for Regression (Model-I)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.722 <sup>a</sup>	0.521	0.416	2.397

a (Table 22) - Predictors: (Constant), other relation, Income 1000-1500, children 2, Maori, Child's Father, age->40, unemployed, other ethnicity, Samoan, Employed in Education Sector, Indian, Income->1500, age- <30, children more than 4, education lower than high school, Income<500, Employed in Health Sector, Income-500-1000, gender-female, age 30-40, New Zealand European.

b (Table 21) - Dependent Variable: Final Health Literacy score

Table 23

ANOVA Table for Regression Mode II

ANOVA <sup>b</sup>					
Model	Sum of Squares	df	Mean Square	F	Sig
1					
Regression	626.112	22	28.558	5.200	.000 <sup>a</sup>
Residual	514.418	94	5.473		
Total	1140.530	116			

\*Significant at  $p < 0.01$ 

Table 24

Model Summary for Regression (Model II)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.741 <sup>a</sup>	0.549	0.443	2.339

a (Table 24)- Predictors: (Constant), other relation, newincome3, children 2, Maori, Child's Father, age->40, unemployed, other ethnicity, Samoan, Employed in Education Sector, Indian, Income->1500, age- <30, children more than 4, education lower than high school, Income<500, Employed in Health Sector, Income-500-1000, gender-female, age2, New Zealand European.

b (Table 23)- Dependent Variable: Final Health Literacy SCORE

## 4.1 Model I

### **Socio Demographic Variables with Oral Health Literacy**

The model one was developed by socio-demographic variables as predictors and oral health literacy as the dependent variable. This returned a statistically significant model ( $F = 4.928$ ,  $df=21$ ,  $p < .001$ ), with  $R^2 = 0.521$ . In this model, significant results were obtained for the gender (male), ethnicity (New Zealand European, Samoan and Indian), employment (in education), and income (less than \$500).

Table 21 illustrates the model summary of the first model. In the developed model, the coefficient of determination is slightly higher than the residual variability. This indicates that variability of Y values around the regression line is 1-0.521 times the original variance. The model explains 52.1% of the original variability and is left with 47.9% residual variability. In this model, except “New Zealand European” all other predictors with significant regression coefficient values have negative regression coefficient. This implies that the relation between health literacy and those predictors was negative that is being of the Indian and Samoan ethnic groups; having gross family income less than \$500; education lower than high school; employed in education are associated with lower oral health literacy scores. The New Zealand European ethnic group has a positive regression coefficient with p value less than 0.05 which shows that oral health literacy increased for those in the New Zealand European ethnic group. The categories such as being employed in other than the health and education sector; gender-female, education lower than high school were excluded from the regression model due to multicollinearity. Even though some of these independent variables seem to be a strong predictor of oral health literacy, they are excluded from the regression model owing to the multicollinearity.

## **4.2 Model II**

### **Oral Health Literacy with Socio-demographic variables and Parents' attitude towards water fluoridation**

The second model ( $F = 5.200$ ,  $df = 22$ ,  $p < 0.001$ ) was developed by including parents' attitudes towards water fluoridation in the first model which rendered the effect of gender (male) as no longer significant and raised the coefficient of determination to 0.549. In the second model income group (\$500-\$1000 per week) and parents' attitude towards water fluoridation were also significant.

These results will now be discussed further in the discussion section of the thesis.



## **Chapter Five: Discussion**

The purpose of this study was to measure the level of oral health literacy of parents of preschoolers in Christchurch city. The developed questionnaire measured the parents' oral health knowledge regarding their child's oral health and their ability to read and interpret health care information. The results inform an understanding of the level of oral health literacy among parents regarding their child's oral health. The association between oral health literacy and parents' attitude towards water fluoridation was another important finding from this study. The results also indicate the parents' awareness in preventing early childhood caries, a major childhood oral health issue. In this chapter, the meaning and importance of the findings, their relevance to parents, policy makers and oral health care providers as well as alternative explanations, recommendations and the limitations of the study, will be discussed.

### **1. What is the level of Oral Health Literacy among parents in Christchurch?**

The key objective of this study was to measure the oral health literacy among the parents in Christchurch. Oral health literacy was measured by measuring the oral health knowledge and comprehension skill of the parents. According to the divided categories, the highest number of participants had moderate oral health literacy. In the total sample (n=117), 37.6% of participants had poor oral health literacy which indicates that those parents who scored lower than 16 on the questionnaire have lower level of oral health literacy in preventing their child's oral health diseases. The analysis of raw oral health literacy scores indicated that the mean oral health literacy score per person was 16.85 (standard deviation [SD] =3.136). The histogram of raw scores was normally distributed with a slight negative skew.

Although very little research has been undertaken in oral health literacy to compare our results, several findings related to oral health literacy were confirmed in the current study. A small number of parents (21.4%) were classified as having high oral health literacy skills and are likely to have a complex knowledge of preventing oral health diseases in their child and have the ability to understand oral health information without any difficulty. As discussed before, analytical results suggest an association between oral health literacy levels and factors that we consider to be the consequences of poor oral health literacy, such as misunderstanding the use of water fluoridation, poor usage of oral health care services and lack of background knowledge to understand health care instructions.

According to the current study, parents who have high oral health literacy had the following knowledge and ability regarding their child's oral health:

- Health promotion (controlling spread of microorganisms and healthy behaviours)
- Health protection (Knowledge on usage of topical fluoride and water fluoridation)
- Disease prevention ( Preventing dental caries and managing teething)
- Health care maintenance (Comprehension skill and shared decision making)
- System navigation ( understanding the available free dental services and knowledge about first dental visit)
- Shared decision making ( Having basic oral health knowledge to make decision and improving existing knowledge by interacting with health care providers)

The parents who have above mentioned knowledge will have ability to protect their children's oral health. Hence, understanding parents' oral health literacy may help to improve the quality of dental care. According to the 2006 Adult Literacy and Life Skill Survey, New Zealanders

on average have poor health literacy and in the current study, on average parents have a “moderate” level of oral health literacy (Satherley & Lawes, 2006). One possible reason for this might be the considerably high number of participants with a university education in our sample compared to the New Zealand population overall.

Bivariate analysis of the raw health literacy scores with socio demographic variables shows that oral health literacy is positively associated with gender, education and family income and ethnicity where the results were statistically significant with p value less than 0.05. The results were confirmed later in regression analysis which indicated that income, education, ethnicity and gender are the biggest determinant of health literacy among the socio-demographic variables. A surprising result in multivariate analysis was negative relation ( $p < 0.05$ ) between the predictor “parents working in education” and oral health literacy. This suggests that oral health literacy seems to be low even among parents working in the education sector. This result suggests that health care providers could avoid using traditional methods of using education and employment as predictors of oral health literacy. Rather than assuming preconceived levels of oral health literacy, health care providers should understand the parents’ level of oral health literacy by measuring or by interacting with parents.

The multivariate analysis confirmed the strong relation between oral health literacy and ethnicity. A statistically significant positive correlation between the predictor “New Zealand European” and oral health literacy suggests that being a New Zealand European is associated with higher oral health literacy. The results of the regression analysis also show that those of Samoan and Indian ethnicity are likely to have lower health literacy. Hence, compared to New Zealanders (Maori and Non-Maori), the immigrant population from second world countries are associated with lower oral health literacy. This could be due to the nature of oral health services in their home countries. In the total sample, there was only one parent of Chinese

ethnicity and Chinese are considered to be one of the major immigrant groups in New Zealand. The Adult Health Literacy Survey indicated that compared to European New Zealanders and other ethnic groups, Maori, Pacifica and Asians are lower performers in adult literacy skills (Ministry of Health, 2010d). In the current study, except for European New Zealanders, all other ethnic groups had a negative relationship with oral health literacy in the regression model. Hence, oral health literacy interventions could be targeted more on Maori and the immigrant population. Health care providers could understand the level of oral health literacy of parents of paediatric patients from Maori and immigrant population to avoid possible misunderstanding and to improve their oral health literacy.

The association between parents' attitude towards water fluoridation and oral health literacy was identified in the descriptive analysis. This association was strong in the regression model ( $\beta = -1.176$ ,  $p < 0.05$ ) which was identified by an increase in the regression coefficient on adding response for water fluoridation with socio-demographic variables in the regression model. Hence, educating people about all aspects of oral health and about preventing oral health diseases would make them to understand the need for the water fluoridation.

The results of the Adult Health Literacy Survey indicated that ethnicity and income were important predictors of health literacy (Ministry of Health, 2010). This result was again confirmed in the current study by obtaining significant regression coefficient for some of the categories among income and ethnic groups. Even though education was one of the important predictors of oral health literacy in bivariate analysis this was not confirmed in the multivariate analysis.

The findings confirm that those with poor oral health literacy, as measured by our instrument, had poorer oral health knowledge and poorer comprehension skill. And this will potentially lead parents to engage in more harmful oral health behaviors in their children, which could cause poor oral health outcomes. Hence, parents could be considered as a focus for interventions in improving oral health status of children by improving parents' oral health literacy. Improving parents' oral health literacy would be achieved by improving their oral health knowledge regarding child's oral health which in turn would increase comprehension knowledge.

## **2. What is the Level of Oral Health Knowledge among Parents?**

The oral health knowledge regarding child's oral health was measured by administering 18 oral health knowledge questions. The parents' oral health knowledge was divided into three categories namely poor, moderate and good. The scores obtained by the parents were divided into three categories. Scores from 0-10 represented "poor", 11-14 corresponded to "moderate" and 15-18 represented "good" oral health knowledge. These categorical distinctions were based on past relevant studies. In the total study population, 23% of parents had poor oral health knowledge regarding their children's oral health. The parents with moderate and good oral health knowledge were 51.3% and 24.8% respectively. Hence in the total population of respondents approximately one in four parents lacked some aspects of oral health knowledge regarding prevention of early childhood caries, basic oral health knowledge, and knowledge on teething and water fluoridation. For a parent to be highly health literate, they are expected to have good knowledge about these factors to protect their child from oral health diseases.

In bivariate analysis, association between socio-demographic variables and oral health knowledge was identified. Statistically significant chi-square values indicated that age, education, ethnicity and income were associated with level of oral health knowledge.

In this section the results obtained in the knowledge test will be discussed under four research questions as follows:

2.1 What is the level of Basic oral health knowledge among parents?

2.2 What is the level of parents' knowledge in prevention of early childhood caries?

2.3 What is the parents' Knowledge about teething and its management?

2.4 What is the parents' Knowledge on system navigation?

Consequence of lack of particular knowledge and implications for improving parents' oral health knowledge will be discussed in this section.

## **2.1 What is the level of Basic Oral Health Knowledge among Parents?**

Basic oral health knowledge is required for a parent to discuss oral health related issues with health care providers and also to obtain or understand oral health information regarding their child's oral health from brochures given in the hospitals, the Government's oral health website and other sources of information. In this study, three basic oral health knowledge questions were asked. They were: Question 1 (A cavity is \_\_\_\_\_), Question 4 (Plaque is \_\_\_\_\_), Question 5 (A dental sealant is \_\_\_\_\_) and Question number 6 (Tooth enamel is \_\_\_\_\_). The majority of participants (90%) gave correct answers to questions 1 and 6 and only 80% of participants gave correct answers to the question about plaque. A possible explanation for this might be repeated exposure to the word "enamel" and "cavity" in toothpaste advertisements. In the total sample, 79.5% of participants answered correctly the question about dental sealant. The slight reduction in the correct response is because pit and

fissure sealant is a procedure carried out by dental health providers to prevent dental caries and chances of knowing about a preventive treatment is comparatively less.

In REALD-30, the words were arranged in increasing order of difficulty and the word “plaque” was listed after the word “enamel”. In REALD-99 the words “cavity” and “Enamel” were listed in the first and second columns but the word “Plaque” was listed in the third column. In both of the above studies the word plaque is considered to be a difficult one. This has been replicated in our study and this result implies that participants had less knowledge about gingivitis than dental caries.

In this study, because the majority of participants had given the correct answer for all basic knowledge questions, people who did not give correct answers are considered to be a at risk population. Low health knowledge will interfere with understanding oral health information and also affect navigation of the health care system. Those parents who have low basic oral health knowledge may participate less in shared decision making. The example below, which is taken from an article published by the Ministry of Health, illustrates the practical use of parents having basic oral health knowledge.

*My son Jayden attends the local kura kaupapa. At six years of age and feeling pleased with himself because of his ‘new teeth that had come through at the back of his mouth’ Jayden went off for his visit with the dental therapist at the mobile dental health clinic. I asked Jayden when he came home ‘What did the dental therapist do?’ My son replied ‘Oh she counted my teeth and cleaned them and told me that I had good teeth’. ‘Did she do anything else?’ ‘No’, was the response.*

*I rang the dental therapist and asked why no preventive work like fissure sealant (protective coating put on molars) was undertaken. She told me that Jayden did not*

*need preventive work and that sealants were rationed. I asked her if she was aware of the oral health inequalities that existed between Māori and Pākehā children. Her reply was that management was responsible for the policy limiting sealant treatments. When asked about delivering services in less deprived areas, and whether the parents would expect preventive services for their children, she said 'yes', the parents would expect that service as of 'right'.*

*In the end the dental therapist agreed with my request for Jayden to have fissure sealants. But I shouldn't have needed to ask. Jayden at six years of age has the **'right'** to receive equitable access to high quality dental health services every time he accesses a dental health provider. Vera Keefe-Ormsby (Koopu & Keefe-Ormsby, 2008)*

In the total sample, 69.2% of participants answered correctly all four questions on basic health knowledge and 20.8% of participants gave one or more wrong answers. More accurate identification of those who have limited basic and oral health care knowledge combined with improved mechanisms for disseminating oral health information would greatly assist those who currently have limited understanding of complex oral health issues to be better informed. This could be achieved by improving the system of delivering oral health information in user friendly/easy to read colourful brochures to reach the public who lack the basic oral health knowledge to understand the complex information about oral health.



## **2.2 What is the Level of Parents' Knowledge on preventing Early Childhood Caries?**

Early childhood caries (ECC) is the presence of one or more decayed, missing or filled tooth (DMFT) surfaces in any primary tooth in a preschool-age child between birth and 71 months of age. ECC can develop extremely quickly and lead to the widespread and sometime painful deterioration of the primary dentition. Kauffman (2001) has stated that, “the supreme ideal of the dental profession should be to eliminate the necessity for its own existence”. This suggestion implies that early childhood caries is preventable with the help of parents. There are three factors which cause early childhood caries, namely sugar-rich food, unprotected teeth and micro-organisms (See Figure 14). Transmission of micro-organisms from parents to children is due to unhealthy behaviours of parents or caregivers who expose pathogenic micro-organisms through intimate contact, sharing and tasting foods on a spoon or pacifier (Freudenthal & Bowen, 2010). Sugar snacking between meals has been recognized as a key behaviour which causes early childhood caries in preschool children (Astrom & Kiwanuka, 2006). Tooth brushing has been proved to be a major factor in reducing dental caries and parents are expected to brush their child's teeth until they learn the techniques and importance of brushing. Daily biofilm removal is essential to control the growth of micro-organisms (Freudenthal & Bowen, 2010). Hence, the three general methods to control dental caries are Chemical measures (fluorides), Nutritional measures (sugar-free food) and Mechanical measures (brushing). Parents are expected to have knowledge of all three measures to prevent early childhood caries in pre-schooled aged children (Peter, 2000)

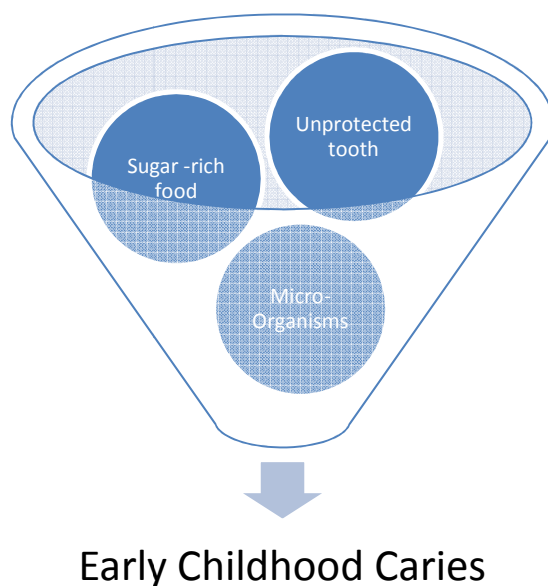


Figure 14 *Factors which Cause Early Childhood Caries*

Hence, parents were asked about their knowledge relevant to brushing, the effect of sugar-rich food and the uses of fluoride in preventing dental caries. In this chapter parents' knowledge of prevention of ECC is discussed under three subtitles namely:

2.2.1 Knowledge of mechanical measures to control micro organisms

2.2.2 Knowledge of nutritional measures to reduce sugar- rich food intake

2.2.3 Knowledge of chemical measures to protect the teeth

### **2.2.1 Knowledge on mechanical measures to control micro organisms**

Healthy behaviours for preventing dental caries are good brushing habits and controlling the spread of micro-organisms by good hygienic behaviour. Hence, questions which test the parents' knowledge related to brushing habits and about controlling the spread of micro organisms were included in the questionnaire. The results are discussed in this section under actual questions as a subtitle.

***When a mother puts her child's pacifier in her mouth to clean it: \_\_\_\_\_***

The above question was added to the knowledge questionnaire to test the parents' awareness of the transmission of micro-organisms. In the total sample, 60.7% of parents gave the correct answer by selecting the option: mouth germs from the mother's oral cavity may increase the chances of early childhood caries in a child. This implies that, nearly 40% of parents were not aware of the transmissibility of pathogenic microorganism from the parent's oral cavity to the child's mouth while sharing utensils. Also they were not aware that such micro-organisms may cause early childhood caries in children.

Freudenthal et al (2010) conducted a study to find the effect of motivational interviewing on decreasing parental risk-related behaviours for early childhood caries. In that study, 33% (n=72) of total participants reported sharing utensils with their children. This result is nearly the same as in our study.

According to evidence, sharing foods and pre-tasting of food by parents or caregivers will cause early infection with *Streptococcus Mutans* in infants (Gussy, Waters, Riggs, Lo, & Kilpatrick, 2008). In the study conducted by Gussy et al. (2008) in Victoria, the majority of participants practised sharing utensils or tasting the child's food on the same spoon at least sometimes. In that study, parents were largely unaware (92%) that the bacteria implicated in dental caries could be transmitted from them to their children with 45% disagreeing with this idea.

***After feeding a baby who has no teeth, his/her gums: \_\_\_\_\_***

One question was asked to test the knowledge of cleaning the baby's gums well before the eruption of teeth. Only 46.2% of parents reported that after feeding a baby who has no teeth, gums should be cleaned with a clean gauze or wash cloth. This indicates that more than half of the parents were not aware of the importance of cleaning the baby's gum after feeding. Failure to clean the gums after feeding will increase the growth of microorganisms in the child's mouth before the eruption of the child's teeth, which causes exposing the milk teeth to pathogenic bacteria and causing early childhood caries.

It is recommended that a child's gum be cleaned using a clean cloth or a wet cloth after feeding (Brodeur & Galarneau, 2006). The reason for cleaning a baby's gums everyday is to get rid of the formula or breast milk because they contain natural sugar which increases the growth of micro-organisms. It is hard to tell when the teeth are starting to erupt in the oral cavity and it is better to start cleaning the gums early. This behaviour will help to get a baby used to having his/her mouth cleansed as part of the daily routine which makes the transition to tooth brushing later on easier (Baby Centre Health Advisory committee, 2006)

***The general rule is that when baby teeth start to come in, they should be: \_\_\_\_\_***

Brushing is considered to be a mechanical measure to prevent dental caries and gingivitis. Brushing will remove the plaque from the tooth surface and control the growth of micro-organisms. Brushing has been proved to be a major measure for preventing dental caries and parents' knowledge regarding brushing was examined in this study.

One third of the parents who participated in the survey answered the above question correctly and two thirds of the parents were not aware of the importance of brushing in preschool aged children.

Saied et al. (2009) conducted a study in parents of children aged 9 years. In this study, almost 97% of parents acknowledged that, twice daily tooth brushing is an important measure in the prevention of dental caries. In a study conducted in Hiroshima, 80% of parents of children in the age group 7-12 years reported brushing their teeth twice a day (Okada, et al., 2002). Brennan et al. (2010) conducted a study in Australia with 2,248 participants aged 45-54 years. The result showed that 98% of the study's participants reported twice daily brushing as important behaviour.

In our study, only 74.4% of participants were aware of the habit of twice daily brushing as healthy behaviour in preschool children which was lower than the results of the above mentioned studies. This difference may be due to the age of the children in our study who are pre-school children. The above mentioned studies had children older than in our study, may be as children get older parent's knowledge about brushing increases. This implies that 24.6% of parents in the current study did not know the importance of brushing their children's teeth at the pre-school age.

A recent survey by International Oral-B power brush showed that one in six New Zealanders dislike cleaning their teeth, 82% said they don't floss once a day and three out of four New Zealanders did not use a mouth wash daily (Revell, 2010). The research also indicated that one in ten New Zealanders admit to brushing less often than once a day. This survey indicated that Americans are more discerning about their own dental care practices than New Zealanders. Parents from both countries were critical of their children's oral health behaviour with one in four reporting that their children had "poor" oral health behaviour (Revell, 2010).

This might be due to the lack of encouragement provided by the parents regarding oral health behaviours. Parents are considered as a role model for all the behaviour including oral health behaviour. Encouraging parents to follow healthy behaviours would increase parents' positive attitude towards their child's oral health.

***Parents/caregivers should brush their child's teeth until\_\_\_\_\_***

Sixty percent of participants answered the above question wrongly. Thirty seven percent of participants answered two years as the correct age for a child to start brushing on their own. At the age of two, children are not ready physically to brush their own teeth as their motor skills are not developed. In the total sample 16% of participants admitted that they did not know the answer to that question.

Parents should be encouraged to supervise or assist their children until they reach the age of eight (Kids Teeth, 2008). A study was conducted in Australia in a stratified random sample of 3,574 parents of 5-6 year old children. This study demonstrated that 19.9% of parents were not supervising or assisting their child while brushing. Of those, children from single parent families (OR=1.31), from families parent with more than 3 children (OR=1.15), families where both parents work full time (OR=1.49) had higher odds of not having their tooth brushing assisted (Armfield, Roberts-thomson, & Spencer, 2007). Armfield et al. (2007) suggested that family resources related to time should be taken into account when determining children's caries risk status. This study demonstrated the importance of parents' assistance in brushing their children's teeth to avoid the early childhood caries.

In a study conducted in Australia, 68% of the parents of preschoolers believed that children were capable of brushing their own teeth by the age of four years (Gussy, et al., 2008). In the present study, 60% of parents were not aware of the importance of assisting their child in

brushing. This indicates that the majority of parents were not aware of importance of parents' assistance in brushing. Hence, present knowledge among parents regarding the value of parental assistance of child tooth brushing until the child turns 8 is not being presented in appropriate manner. In current, oral health brochures information about when to start brushing and how to brush child's teeth are available but information regarding importance of parental assistance until the child turns 8 is not given (see Appendix-N and O). Future brochures could include this information to improve parental awareness regarding this. Thoroughness is important for effective plaque control and it would be worth conducting individualized tooth brushing programs for the parents by the oral health providers. In such programs health care providers should assess the manual dexterity and level of responsibility of a child to determine the degree of parental involvement needed for the child.

The parents of a child who has a developmental disorder should be advised that brushing will clearly be the responsibility of parents (McDonald & Avery, 2001). As power brushes have proven to be better in plaque removal than manual brushes (Revell, 2010) for atraumatic plaque removal in disabled children (McDonald & Avery, 2001). Although there would be an associated cost, it would be worth conducting a feasibility study to compare the cost of providing power brushes and cost of dental care to those with developmental disorder. This may possibly decrease the additional burden of dental care to those with developmental disorder. Working parents would be encouraged to brush their children's teeth in the evening, since the evening provides a time when family activities are less hurried. Also brushing before bedtime can be recommended because salivary flow and oral movements decrease during sleep, which encourage the growth of bacteria (McDonald & Avery, 2001).

### **2.2.2 Parent's knowledge on nutritional measures to reduce sugar-rich food**

In the knowledge questionnaire, two questions were asked regarding the parents' knowledge of the effect of sugar in causing dental caries. In the total population, 76% of participants answered the two questions correctly regarding knowledge of nutritional measures to reduce sugar-rich food. This indicates that one in four parents lack knowledge of the effect of sugar in causing early childhood caries.

#### ***(i) Putting a child to bed with a bottle of milk\_\_\_\_\_***

In the total sample, 80% of parents understood that putting a child to bed with a bottle of milk will cause cavities. Most of the mothers use a variety of bedtime strategies as evening rituals to help their children go to sleep and which involve giving the child sugar (See Figure 15). The cariogenic bacteria metabolize the lactose in the milk quickly (Brodeur & Galarneau, 2006). The oral flora come into contact with the lactose for a longer period of time in the night and this increases the chances of development of early childhood caries. Unhealthy bedtime rituals followed by some mothers include: giving a sweet treat, giving a highly cariogenic drink such as sugar rich juice and milk either in a cup or a bottle that is taken directly to the bed, and giving candy (Brodeur & Galarneau, 2006).

Gussy et al. (2008) demonstrated in their study that 90% of parents disagreed with the statement "children who were bottle-fed developed tooth decay". Approximately half of the parents reported that their children had a bottle at bed time, and in the total sample 21% of parents admitted using a bottle at bed time always. Only 5.5% of parents believed that use of bottles at night time was the most important factor in causing dental caries (Gussy, et al., 2008).



A study conducted in Montreal, showed that 29% of parents exposed their children to dental caries by putting them to the bed every night with a bottle of milk (McDonald & Avery, 2001). In the intervention study conducted by Freudenthal et al (2010), there was statistically significant ( $p=0.05$ ) improvement in parents' behaviour regarding brushing habits and sharing the utensils after the motivational interviewing in the control group but the behaviour of using a bottle during bed time was unchanged. This result implies that the habit of using a bottle during bedtime is difficult to modify because of the chance that the child has become adapted to the routine.

Hence, rather than weaning the child from the behaviour of using the bottle at bed time, it is better to prevent it right from the birth. Galarneau and Brodeur (2006) suggest that to prevent a caries causing soothing routine, parents should be informed at the earliest opportunity. In my view, this earliest opportunity would be during the pregnancy. This can be done by the midwife or health care providers at the later stage of pregnancy or by Plunket nurses before the child gets into the habit. This will give mothers a good start in introducing healthy soothing habits from the birth of the child, and help parents to avoid any harmful routines that are difficult to stop.



effect of sugary snacks on dental caries, the parents have some unexplained intention to give sugary snacks to their children. This has been demonstrated in a study conducted by Astrom and Kiwanuka in Uganda in which, parents who said controlling sugar prevents tooth decay reported having a strong intention to give sugary snacks to their children (Astrom & Kiwanuka, 2006). In our study the parents' attitude towards giving sugary snacks has not been measured, because we measured the parents' level of knowledge. The result showed that the majority of the parents were aware of sugar as one of the main risk factors in causing dental caries. Parents' attitude and intention to give sugar snacks to preschool aged children can be identified in the future studies to reduce sugar intake. At present, tip cards containing healthy food ideas and effect of sugar snacking are distributed to the parents attending community dental clinics. If those cards were also distributed in preschools and GPs, number of parents who receive those tip cards may be increased. Parents who have not enrolled in oral health services and those who do not make frequent visits to community dental clinic could also get a chance to receive such information.

A study in the UK showed that there was a reduction in caries in pre-school aged children from a reduced intake of sweets in kindergartens and day care centres (Rogers & Hector, 2003). Hence, preschool centres and kindergartens in New Zealand can be encouraged for sugar free lunch to reduce early childhood caries in preschool aged children.

In New Zealand, soft drink consumption by children has been increasing dramatically, owing to soft-drink vending machines having been placed in most schools in the country (New Zealand Food Award, 2005). In a 2002 New Zealand Nutrition survey, sucrose was indicated as the major contributor to total sugar intake by children in New Zealand (Ministry of Health, 2003). The main sources of sucrose for New Zealand children were beverages (26%) and sugar and sweets (21%) (See figure 16). The total intake of sugar per day by New Zealand

children aged 5-14 years old is 103g-140g (23-29 teaspoons). This survey indicated that the highest sugar intake was by Maori children (Ministry of Health, 2003).

Hence, the New Zealand Government can implement relevant policies to reduce the consumption of sugar by New Zealand children which would encourage them to take sugar-free food. Currently tip cards with information regarding healthy sugar free snacks (see Appendix P) are distributed to the parents attending community dental clinics (Personal Communication, Tournn Borsting, 2010), those cards can be distributed in preschools and GPs to increase the awareness among the parents. Selling sugar rich food in a school zone should be avoided because of the natural tendency among children to prefer sugar-rich food. Ministry of Health data on nutrition is available only for 5-14 year old children and the amount of sugar consumed by pre-school aged children in New Zealand has not been measured (Ministry of Health, 2003). Future nutritional survey could include preschoolers and those results may be used for controlling sugar-rich food in preschoolers.

Parents should avoid taking pre-school aged children to the super markets where most of the sugar rich foods are accessible by the preschool aged children. By this way parents can control the temptation to the child and parent's intention to give child the sugar rich food. Pre-school centres should encourage parents to avoid sugar-rich foods in the lunch box. These effects would increase parents' awareness about effect of sugar rich food.

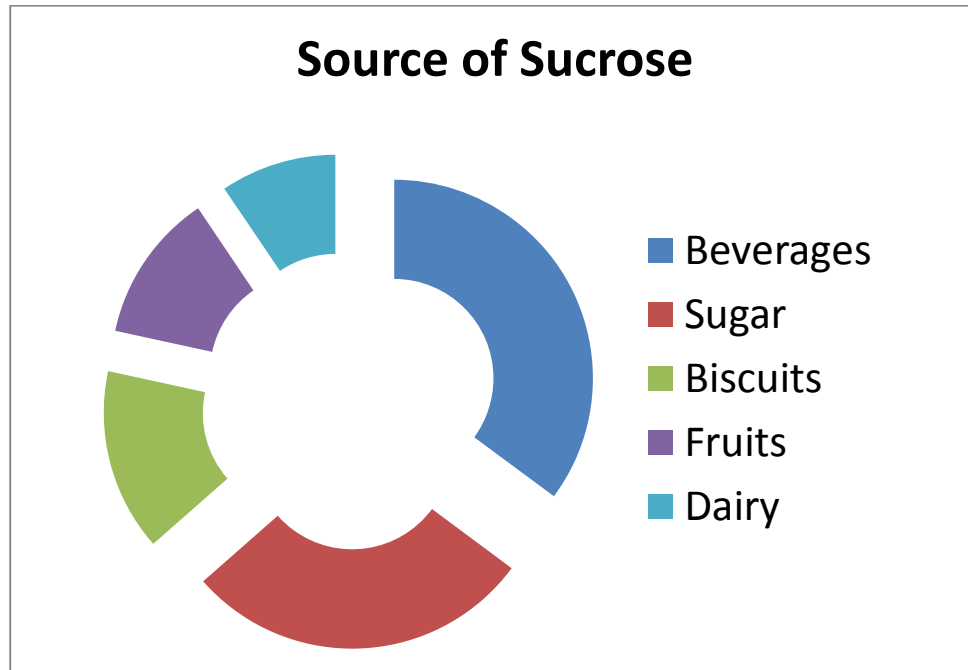


Figure 16 *Major Source of Sucrose for New Zealand Children*

(Source: New Zealand Nutrition Survey, 2003)

Rogers and Hector (2003) suggested that paediatric medicines should always be sugar free. Their study showed that 95% of dentists and health providers who participated in their study recommended sugar free medicines (Rogers & Hector, 2003). Most of the paediatric medicines are suspension and their consistency makes them to stick to the plaque, fissures and groves in the child's teeth. Even if sugar rich medicines are prescribed by the paediatrician, the label recommending the medicine be taken before brushing might help prevent dental caries from this source. A study was conducted among pharmacists in Ireland and 74% (n=52) stated that they had not received formal education concerning sugar in medicine and its effect on dental health. This study also indicated that the major factors influencing that the provision of sugar free medicines were parental request, health promotion literature, reports and media advertising (McVeigh & Kinirons, 1999). Therefore, awareness about effect of sugar rich medicine among New Zealand pharmacist could be encouraged by the Government and health care providers to dispense sugar free medicine for children.

### **2.2.3 Parents' knowledge on chemical measures to protect their child's teeth**

The chemical measures that are used to control dental caries are topical fluorides such as fluoride rich toothpaste and community water fluoridation. There were three questions included in the questionnaire to test the level of parents' oral health knowledge related to chemical measures to protect the teeth. Fluorides are considered to be one of the best chemical measures to control the caries activity in the oral cavity. Fluorides control caries activity by the following anti-caries action:

- Interference in bacterial enzymatic processes
- Direct bactericidal action
- Reduction in plaque formation
- Enamel remineralisation
- Stimulation of the formation of large apatite crystals
- Lowering the solubility of enamel

For young children, two widely used fluoride supplements are fluoride dentifrices (tooth paste) and community water fluoridation. In this section, parents' knowledge of the effect of fluoride toothpaste and water fluoridation in dental health is discussed under two headings:

(i) Fluoride tooth paste

(ii) Water fluoridation

#### ***Fluoride tooth paste***

The benefits of topical fluoride provided by a dentifrice are well documented in the literature. Parents were asked about the amount of fluoride toothpaste to be used by pre-school aged children and about the concentration of fluoride in children's toothpaste.

**The amount of fluoride toothpaste that should be used for a child of 2 years or older is:**

The preschool aged child is usually unable to expectorate completely after brushing and toothpaste placed in the toothbrush will generally be ingested. Repeated ingestion of large amounts of fluoridated toothpaste by young children may cause systemic fluoride intake to undesirable levels and cause dental fluorosis. According to 2010 fluoride guidance, only a smear of fluoride toothpaste should be used for children aged 6 and below (Ministry of Health, 2010b). Hence, the above question was added to the questionnaire to discover parents' knowledge of the recommended amount of toothpaste that should be used.

Eighty seven percent of participants selected the correct answer for this question, which indicates that the majority of parents were aware of the correct amount of fluoride toothpaste to be used for young children. In a study conducted by Gussey et al (2008) in Australia, 76% of parents were aware that small amounts of fluoride toothpaste are recommended for toddlers. The responses are nearly equal in both the studies. Of greatest concern in the present study was, nearly 11% of parents selected the option "Enough to cover the whole toothbrush". Even if those parents use an adult's toothpaste or even a child's toothpaste for the child, there is a risk of fluorosis in permanent incisors. One of the reasons for recommending that parents supervise their child's brushing is to avoid swallowing toothpaste while brushing. If parents use large amounts of toothpaste that covers the whole toothbrush, this is not acceptable for children under the age of six, because, permanent teeth are developing at this time and swallowed fluoride containing tooth paste will increase the systemic fluoride level. This is especially the case in areas where water has been fluoridated as the chances of fluorosis of permanent teeth increase. There is great concern among people about poisoning related to fluoride toothpastes and Peter (2001) argues that a 270 gram family size tube of toothpaste (the largest container of toothpaste manufactured) consists of 270mgF and a certainly lethal

dose is 320mg. Thus, it is unlikely that highly toxic amount of fluoride will be received from a single tube (Peter, 2001). Oliveria et al. (2007) indicated that, other than fluoride, dentifrices contain sodium Lauryl sulphate and other laxative substances which may cause diarrhoea and death if untreated. Hence, parents should be strictly advised by health care providers to keep the toothpaste where the child cannot reach.

Today's toothpastes are flavoured and children find them tasty and tempting to swallow. Oliveira et al (2007) conducted a study in Brazil to determine the fluoride intake by children at risk of dental fluorosis from using flavoured and unflavoured dentifrice. The study was conducted with 42 children and participants were asked to brush their teeth with flavoured and unflavoured toothpaste for three days in a seven days interval. Children were instructed to brush their teeth by providing a new tooth brush with 0.5 gram tooth paste, distilled water and a plastic cup to spit water into after brushing (Oliveira, et al., 2007). The samples were collected on the first three days with unflavoured tooth paste and on the second three days with flavoured toothpaste. The suspension collected in the plastic cup was tested in a biochemistry lab for the amount of fluoride. Then the amount swallowed was calculated by subtracting the obtained fluoride from the fluoride in the 0.5gram of tooth paste. The result indicated that the amount of specially flavoured dentifrice swallowed was 0.51 mg F/kg body weight/day and with unflavoured dentifrice the dose was 0.046 (P=0.016). Hence, the amount of fluoride ingested by using flavoured toothpaste is more than with unflavoured dentifrice (Oliveira, et al., 2007). Hence, oral health providers would advise parents to use unflavoured fluoride toothpaste for their children. The Government's fluoride guidelines could include the use of unflavoured fluoride toothpaste to avoid the chances of fluorosis.



**(ii) The best fluoride toothpaste for your child is: \_\_\_\_**

This question was asked in order to discover the parents' knowledge of the recommended percentage of fluoride in children's toothpaste. Only 23% of parents gave the correct response to this question and 51.3% of parents admitted that they did not know the answer. This indicates that the majority of parents in the community are not looking at the ingredients and the amount of fluoride present in their child's toothpaste. Even though children's toothpaste is available in the supermarket, parents are expected to know the percentage of fluoride present in the toothpaste. If parents know the difference in the percentage of fluoride in the toothpaste between adult and children's toothpaste, it will make them aware of not using adult toothpaste for their children. It is possible that 77% of parents involved in this study were not aware of the difference between fluoride concentration in adults and kids tooth paste.

The fluoride percentage in toothpastes is different for each brand available in the supermarket. Fluoride is also in different forms such as sodium mono fluorophosphates, sodium fluoride, stannous fluoride or amine fluoride (Ministry of Health, 2009). The percentage for these different forms of fluoride will be different. Hence, toothpastes can be marketed with the fluoride concentration represented in "ppm" (parts per million) to avoid confusion for the parents. It should be 1000ppm for the adults' toothpaste and 400ppm for the children's toothpaste (Ministry of Health, 2009).

As people can buy toothpaste on the internet and in other ways, health care providers should check their child patient's toothpaste or recommend some toothpaste for children in a routine GP visit. In communities with non-fluoridated water, oral health providers should identify low risk and high risk patients in order to treat them according to the fluoride guidelines recommended by the Ministry of Health (2009) (See Figure 17).

## Algorithm Guidelines for the use of fluorides

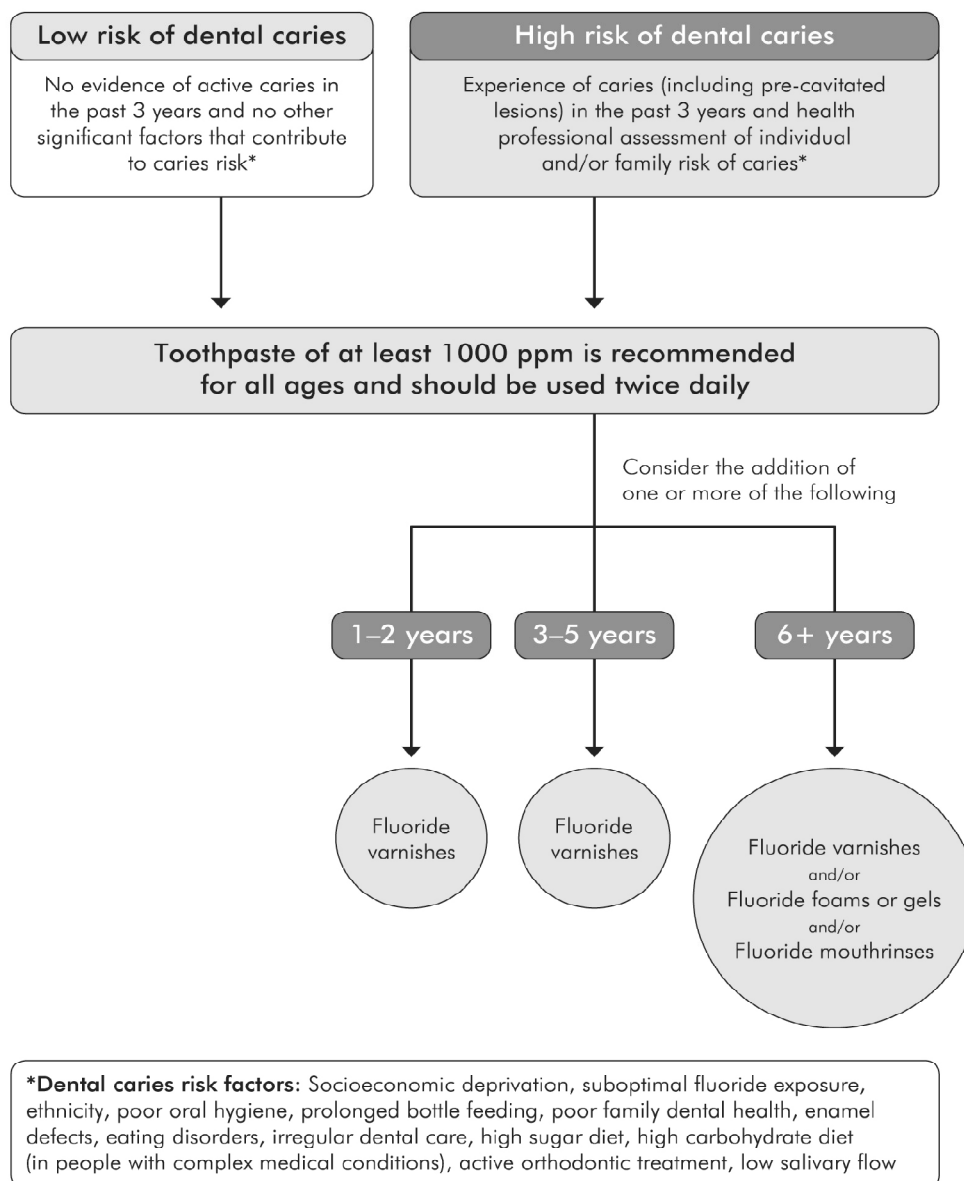


Figure 17

*Algorithm for use of Topical Fluorides*

(Source: Ministry of Health, 2009)

**(ii) Water Fluoridation**

Water fluoridation is considered to be the most important chemical measure to control early childhood caries. In the present study, two questions were asked related to water fluoridation. One question was about the parents' knowledge of the effect of water fluoridation and the other was about the parents' attitude towards water fluoridation in Christchurch.

“Water fluoridation is defined as the upward adjustment of the concentration of fluoride ion in a public water supply in such a way that the concentration of fluoride ion in the water may be consistently maintained at one part per million (ppm) by weight to prevent dental caries with minimum possibility of causing dental fluorosis” (Peter, 2001, p.278).

Many studies have shown a reduction in dental caries due to water fluoridation. The first water fluoridation was begun in Grand Rapids, USA, in 1945 and was quickly adopted by many countries throughout the world. Water fluoridation is the most common form of systemic fluoride administration and provides a low concentration of fluoride to the teeth over a long period which circulates through the blood stream and is incorporated into developing teeth (Peter, 2001). Also fluoride is excreted in saliva up to two third of concentration in plasma and acts as topical fluoride

Hence, fluoride is considered a protective factor and several studies have looked at knowledge, beliefs and attitudes regarding oral health that sought information about fluorides. Thereby, most of the studies are conducted to promote appropriate early exposure to fluorides by the toddlers (Gussy, et al., 2008). With the same goal, questions about water fluoridation were included in this study. Parents' attitude towards water fluoridation and its association with oral health literacy will be discussed later in this chapter.

### **2.3 What is the Parents' Knowledge about Teething and its Management?**

The recent evidence has demonstrated that localized symptoms of teething vary between individuals but systemic disturbances are not related to teething (Owais, et al., 2010). Various studies have demonstrated the myths among the parents related to teething (Owais, et al., 2010; Swann, 1979) and have been conducted to educate parents regarding teething. Hence, knowledge about teething is important for a parent to manage problems due to teething. In the current study, four questions were included in the questionnaire to measure parents' knowledge regarding teething.

*Generally, the first teeth appears in the mouth at the age of \_\_\_\_\_*

For the above question 80% of participants gave the correct answer. This question was added to measure parents' knowledge of monitoring children's teething. Owais et al. (2010) reported that 76.9% of participants gave the correct answer for the same question in an Australia study. In current study 17% of participants provided the wrong answers and 3% of parents admitted that they did not know the answer to this question.

In a study conducted in New Zealand among Plunket nurses, 58% of participants reported that they have given advice regarding teething to their clients (Drummond, et al., 2002). In that study, advice regarding teething was considered as the major child dental health advice given by the Plunket nurses (Drummond, et al., 2002). This might be the reason for the high correct number of responses to this question in the current study. At the same time, every Plunket nurses can be encouraged by the Government to give dental health advice to increase the awareness among parents. Because Plunket nurses are considered the first dental health care advisors in New Zealand, even before children are enrolled in the community dental clinic or school dental clinic. Also in that study only 11.6% of nurses admitted that they carried out an

oral examination for children less than 2 years. Most deciduous teeth erupt in the oral cavity before this age and this shows that teething was not examined or monitored by the Plunket nurses. To create awareness for the parents and to rule out any systemic diseases at an early stage of life, children should be examined for teething and problems related to it. Parents should be provided with calendars or brochures with teething information to monitor it (see Table 26).

Table 25

*Average ages of Tooth Eruption* (Source: McDonald & Avery, 2001)

	<i>Upper teeth</i>	<i>Lower teeth</i>
Primary teeth		(months)
Central incisors	8-13	6-10
Lateral incisors	8-13	10-16
Canines (cuspids)	16-23	16-23
First molars	13-19	13-19
Second molars	25-33	23-31
Permanent teeth		(years)
Central incisors	7-8	6-7
Lateral incisors	8-9	7-8
Canines (cuspids)	11-12	9-10
First premolars (bicuspid)	10-11	10-12
Second premolars (bicuspid)	10-12	11-12
First molars	6-7	6-7
Second molars	12-13	11-13
Third molars	17-21	17-21

*The delayed eruption of teeth may be due to\_\_\_\_\_*

For this question, majority of participants (63.2%) admitted that they did not know the answer to this question and only 17.9% of participants gave the correct answer to this question. The results imply that a considerable number of participants (82%) did not know the answer to this question. There are various systemic diseases which cause delayed tooth eruption in children such as Down's syndrome, Cleidocranial dysplasia, congenital hypopituitarism, congenital hypothyroidism, Gaucher disease, and Osteopetrosis (Holt, 2001).

In Owais et al's (2010) study population, 63.5% of participants agreed that systemic diseases delay tooth eruption. There is a huge difference between these two responses. A possible reason for this might be the pattern of the question asked regarding the effect of systemic diseases on the tooth eruption. In Owais et al's (2010) study, the question was asked with an "agree" or "disagree" response but in the current study the question was designed using multiple choice responses with "breast feeding" and "thumb sucking" as other choices. At the same time questions asked in both studies had an option "don't know" and only 14.7% of participants selected this option in Owais et al's (2010) study compared to 63.5% of participants in the current study. Hence, it appears that awareness regarding the effect of systemic diseases in delayed tooth eruption is low among the parents of New Zealand.

Teething could be monitored by health care providers in usual GP visits and during the child's visit for vaccinations. Oral health providers could improve parents' awareness using flyers or tip cards. Awareness regarding the effect of systemic diseases on teething can also be increased and this could be done by advising parents to monitor their child's teeth using scratch cards and those cards can be checked by oral health providers on dental visits.

*Teething causes \_\_\_\_\_ and To manage pain due to teething \_\_\_\_\_*

Various studies have investigated parental beliefs regarding teething signs and symptoms and demonstrated the various myths among parents. As discussed in the literature review section, it is desirable for parents to have knowledge regarding the symptoms of teething and managing teething problems. Hence, these two questions were added to the health knowledge questionnaire.

In the total sample, 65% of participants gave the correct answer to the first question and 78% of participants gave the correct answer for managing pain due to teething. Unlike the responses to other questions asked in the survey, these two questions received a considerable number (10%) of multiple responses. The multiple response included “fever above 38.9 degrees” as one of the responses for the first question and 13.7% of parents believed that teething causes only fever. The multiple responses given by the parents, even after the instruction which clearly stated to select only one answer, indicated that those parents strongly believed that teething causes fever in children.

Parents awareness regarding teething and managing teething can be increased by oral health education. Some studies have investigated parents’ attitude to giving self-medication to their child when they consider that a usual fever due to various pathological reasons is a fever due to teething. As paracetamol has been shown to cause various side effects in children, children’s formula should be restricted from being sold as over the counter medicine. Misinterpreting fever caused by some other systemic illness as fever due to teething may lead to a delay in diagnosis and late management of some serious illnesses.

Parents should be advised to contact health care providers for reassurance, if children have some problems regarding teething. If teething is confirmed, parents may be advised to give

the child a chilled object to bite which may give some relief from soreness through the pressure of biting. Hard vegetables or teething rusks without sugar may also be given. Care must be taken to avoid choking.

Even if paracetamol is prescribed by the doctor, a sugar-free dosage is preferable to avoid bacterial growth from sugar. A non-irritating topical anaesthetic gel may be used if the child finds discomfort in eating and chewing food.

## **2.4. What is the Parents' Knowledge on System Navigation?**

### **2.4.1 Children should first see a dentist\_\_\_\_\_**

System navigation is considered as one of the domains in the recent health literacy surveys and it is defined as gaining access to needed services and understanding rights. To measure the parents' knowledge of their ability to use the services, the above question was added in the questionnaire to measure parents' knowledge regarding the navigation of free oral health services.

In New Zealand, free dental services are provided to children aged 0-17 years. Parents can use school dental services and may choose to use a 'pay as you go' private dentist for services for their children. The treatments which are difficult to treat in school dental settings are referred to community dental clinics. Hence, all children are expected to use the Government's free dental services as soon as possible.

The majority of participants (60%) answered this question correctly by selecting the option "by age one" and nearly 30% of parents reported that the child should first see a dentist when they start school. According to a Canterbury District Health Board Business Case Summary (Ministry of Health, 2007), only 70% of children aged 3-4 years in Canterbury are enrolled in



dental services and for children 1-2 years it is much lower and the percentage is not known. Percentage of enrolment in 1-2 years age group may be identified in future surveys to improve number of early enrolment.

The results of a Christchurch health and development study indicated that enrolments of preschool aged children were high for upper socio economic families (Koopu & Keefe-Ormsby, 2008). This shows that in part owing to a lack of health literacy parents are unaware of the Government's free dental services. To measure this argument in the current study, the responses to this question were correlated with socio-demographic variables such as ethnicity, income, education and also with raw health literacy scores. The results indicated that knowledge of system navigation produced a statistically significant association with oral health literacy ( $p < 0.005$ ) and ethnicity ( $p < 0.005$ ). The association with income and education were not statistically significant. Our result indicated that parents with high oral health literacy have a tendency to enrol early in oral health services. This implies that improving oral health literacy could improve early enrolments in oral health services.

The purpose of the early dental visit when the child turns one year is to assess the individual caries risk to prevent oral diseases. Anticipatory guidance is another goal during the first dental visit, in which oral health information about the child's oral health status is provided to parents which helps them to understand about the prevention of early childhood caries. Rozier et al (2004) suggested that paediatric primary care providers should carry out compulsory referrals to oral health services when a child reaches one year. Hence, as discussed, the child's primary health care provider (GP) could encourage parents to enrol their children in oral health services because the need for oral health consultation in preschoolers is usually ignored by the parents.

### **3. What is the level of comprehension knowledge among parents in Christchurch?**

Comprehension knowledge is defined as the ability to understand the information from the written material. According to William and Thomas (2005) comprehension knowledge is improved by enriching the background knowledge (Christen & Murphy, 1991). Hence, a passage was given to the parents and parents' level of understanding the oral health instruction in the oral health materials was tested by asking five questions about the oral health instruction in the passage. In the total sample, 74.4% of participants answered correctly all five questions about the comprehension and scored 5. The total mean score was 4.650 with a standard deviation of 0.699 which represents that the majority of parents scored above 4 in the comprehension test. To calculate, and to divide categories of oral health literacy scores, the comprehension score was dichotomised into two categories giving 1 for those who had five correct answers and 0 for the scores  $\leq 4$ . Twenty five percent of participants answered at least one question wrongly out of five. Even if someone answered only one question wrongly, it shows that those parents have difficulty in reading and interpreting health care information.

A weak positive Spearman's rank correlation ( $\rho=0.233$ ,  $p<0.05$ ) between oral health knowledge scores and comprehension knowledge scores was obtained in the current study. Overall most parents either had high oral health knowledge scores and high comprehension knowledge scores or low scores on both oral health knowledge and comprehension knowledge. But a few parents scored highly in oral health knowledge and scored low in the oral health knowledge test but had a high comprehension test score. This shows that some participants who have low health knowledge may have good comprehension skills. Hence, this result supports our idea of including both oral health knowledge questions and comprehension questions in measuring the oral health literacy, in spite of having some

standard instrument available for use with only comprehension knowledge tests such as TOFHLA; and a word recognition instrument such as the REALD-30, REALD-M and REALD-99. To obtain the best measure of oral health literacy, a questionnaire needs to include sections on both oral health knowledge and comprehension knowledge.

Most of the studies conducted to develop oral health literacy instruments compared the oral health literacy with general health literacy instruments such as TOFHLA or s-TOFHLA (general comprehension test) to predict the validity of the developed instrument (Gong, et al., 2007; Lee, Rozier, Daniel.Lee, Bender, & Ruiz, 2007; Macek, et al., 2010). The only study which compared the dental comprehension knowledge with oral health knowledge scores was conducted by Sabbahi et al. (2009) to test whether oral health knowledge was one of the domains in measuring oral health literacy. There was a strong correlation ( $\rho=0.651$ ,  $p<0.001$ ) present between oral health knowledge and comprehension knowledge scores in their study compared to the weak correlation ( $\rho=0.233$ ,  $p<0.05$ ) in our study. One possible explanation for this difference might be due to the samples. Unlike our study participants in Sabbahi et al.'s (2009) study was a convenient sample recruited from the dental clinic in the University setting. Hence, the number of participants who had finished a university degree was high (77%) in their study compared to the current study (60%). Sabbahi et al. (2009) indicated that frequency of dental visits increased the comprehension knowledge score and oral health knowledge in their study which also explains another possible reason for the high Spearman rank's correlation in their study.

The frequency analysis implies that risk groups such as parents with low education, families with less weekly income, immigrants and the indigenous population have less comprehension knowledge. In further analysis, association of a comprehension knowledge score with socio demographic variables were determined and results indicate that there was a statistically

significant association present with gender and family income. Future research could be conducted including an equal number of participants in all categories in a large sample to find out the risk group parameters of importance.

The health care providers are expected to know patients' ability to understand written health care materials and background knowledge before distributing written instructions to them. The following example illustrates the effect of misunderstanding healthcare prescriptions due to lack of background knowledge.

*"A woman in Arkansas brought her baby in to see the doctor, and he determined right away the baby had an earache. He wrote a prescription for eardrops. In the directions he wrote, "Put two drops in right ear every four hours" and he abbreviated "right" as an R with a circle around it. Several days passed, and the woman returned with her baby, complaining that the baby still had an earache, and his little behind was getting really greasy with all those drops of oil. The doctor looked at the bottle of eardrops and sure enough, the pharmacist had typed the following instructions on the label: "Put two drops in R ear (read as rear by parent) every four hours." (Top ten funny health stories, 2010)*

Hence in this example if the parent had some background knowledge and good reading comprehension knowledge, they would have interpreted "R ear" as "Right ear" as opposed to rear. Mack et al. (2010) indicated that patients need conceptual knowledge to read health care instructions.

Before prescribing any drug or giving any written post-operative instructions health care providers should make sure patients understand the instructions or have the ability to understand the written materials. Those patients with English as a second language should be

offered an interpreter or double checked for their understanding of the instruction to avoid any problem due to a misunderstanding. Stevenson et al. (2000) indicated that misunderstandings of health care information are usually based on inaccurate assumptions and guesses by both doctors and patients. Hence, rather than guessing, doctors may interact with patients to determine their ability and back ground knowledge to understand their disease conditions and treatment procedures.

#### 4. What is the Attitude of Parents regarding Water Fluoridation in Christchurch?

In the total sample, 43.6% of participants responded as not wanting Christchurch water supply fluoridated and 56.4% of participants admitted that it should be fluoridated. On the question regarding the effect of fluoride, 73.5% of participants believed that fluoride in water prevents dental decay and 7.7% of participants felt that fluoride in the water causes systemic diseases. In the total sample, 16.2% of participants admitted that they did not know the answer on the effect of fluoride in water.

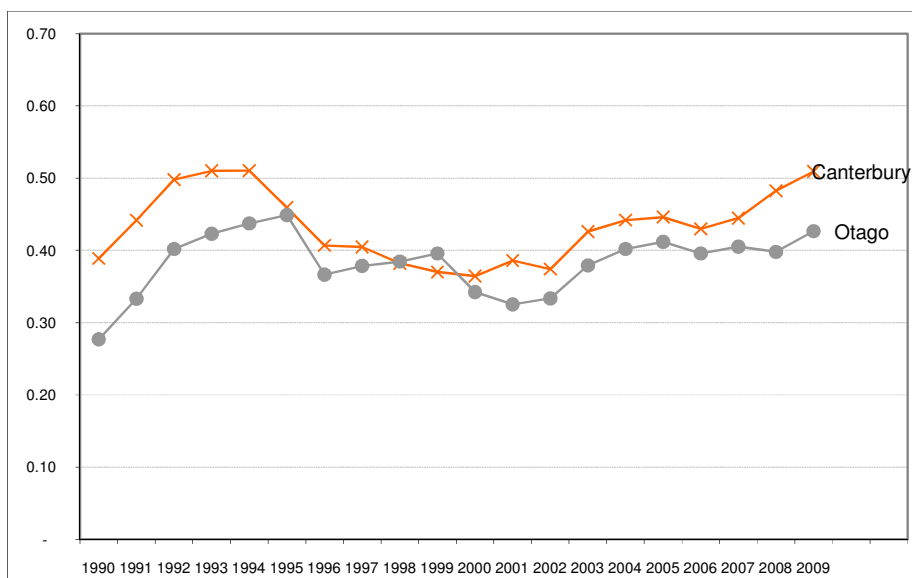
In a study in rural Victoria, nearly half of the parents (50%) felt that water fluoridation was helpful in preventing dental caries which was lower than the result of our study (Gussy, et al., 2008). In that study, 11% of parents disagreed that water fluoridation causes a reduction in tooth decay and 38% of the participants did not know the effect of water fluoridation on dental caries (Gussy, et al., 2008). Even though 73.5% of participants agreed that fluoride in water prevent dental decay in current study, only 56.4% of participants wanted water fluoridation in Christchurch. This difference might be due to confusion among parents about water fluoridation which might be created by the water fluoridation opponents in New Zealand. At the same time there was a statistically significant association ( $X^2 = 16.604$ ,  $p < 0.001$ ) present between parents' knowledge on water fluoridation and parents' attitude

towards water fluoridation in Christchurch, with higher knowledge being associated with positive attitudes towards water fluoridation.

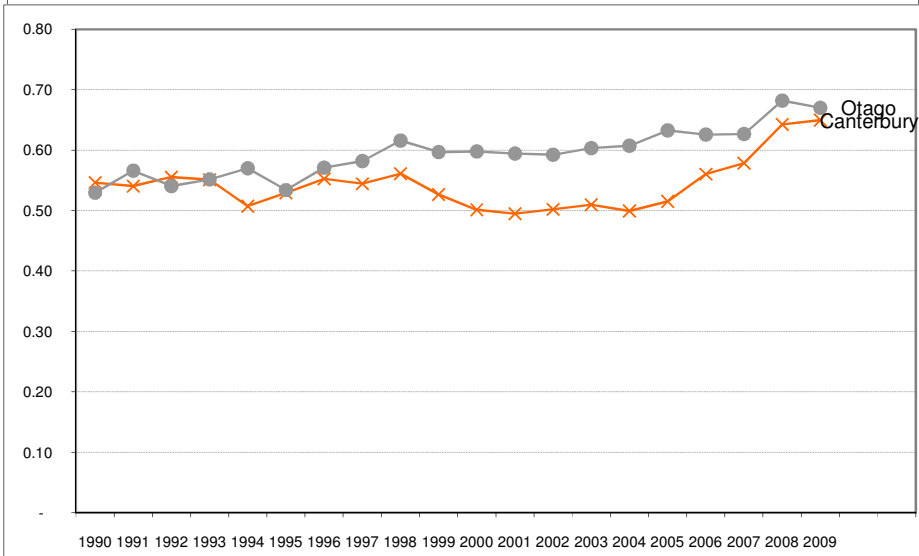
As in other part of the world, water fluoridation is a controversial subject in New Zealand (Kanagaratnam, Schluter, Durward, Mahood, & Mackay, 2009). In New Zealand, water fluoridation is endorsed by the Ministry of Health and rejected by some communities and organisations such as the Fluoride Action Network (Kanagaratnam, et al., 2009). Current evidence and data from the Ministry of Health suggest that fluoridation leads to a reduction in caries in the communities with water fluoridation in New Zealand (Ministry of Health, 2009). The data also indicates that in fluoridated water areas, caries reduction is higher in five year old children than in 12 year olds (Ministry of Health, 2009). This indicates that water fluoridation is much more effective in preschoolers than in 12 year old children. Figure 18 illustrates the percentage of caries free children in Otago and Canterbury which are considered the highest and least fluoridated areas of New Zealand respectively (Ministry of Health, 2009). As shown in Figure 18, in Otago the number of caries free five year old children was high compared to Canterbury. At the same time, the number of caries free Year 8 (12 years old) children was low in Otago compared to Canterbury. A possible explanation for this might be that, in Canterbury, children are exposed to dental treatments at early stages (owing to the high caries rate in 5 year old children) and awareness about preventing dental caries increased among parents and children which causes a decline in dental caries in year 8 children of Canterbury. This argument has been demonstrated in various studies in that there are reduced DMFT rates both in adult and child patients owing to frequent dental visits (Sabbahi, et al., 2009). Even though it is a positive effect, dental treatments in a child patient is much more stressful than in an adult patient.

Topical fluoride such as fluoride varnishes and fluoride containing sealants are less effective in preschool aged children for various reasons such as lack of co-operation and difficulties in the isolation of the tooth (Peter, 2001). Also excessive ingestion of fluoride in gel application by under five year olds may result in acute toxicity (Jiang, Bian, Tai, Du, & Peng, 2005). According to Stone and Church (1975), co-operative behaviour is less in toddlers and preschoolers, therefore systemic fluoridation such as water fluoridation is effective for preschoolers and Christchurch city is a major city without water fluoridation in New Zealand. In the Canterbury region, water fluoridation was stopped in three districts namely Ashburton (except Methven), Timaru and Waitaki districts owing to opposition by anti-fluoridation campaigners (Fluoride action network, 2009).

### Caries rate in Five year Olds



### Caries rate in Year Eight



*Figure 18 Caries free Children in Otago and Canterbury*

*(Source: Ministry of Health, 2009)*



Peter (2001) indicated that following reasons for the public rejecting water fluoridation, a measure proven to be good for the oral health, are:

- Ignorance and confusion about the dental health benefits of fluoride
- Uncertainty about the science and its by-product
- Misrepresentation of the technical information by opponents enabling them to distort the issues and frighten the public.

The actions of anti-fluoridation opponents in New Zealand include publishing books (*The case against Fluoride*); selling DVDs (*The fluoride deception*, *Professional Perspectives on Water Fluoridation*) and T-shirts (see Figure 19); and distributing flyers (See Appendix-J, K, L and M). The information they distribute includes wrong information such as fluoride prevents tooth decay by slowing down the eruption, the presence of lead in fluoridated water and fluoridated water decreases IQ. This information is distributed without any evidences to support their claims (Fluoride Action Network, 2009). Data and reports available on the Ministry of Health website, demonstrates the effect of water fluoridation in preventing caries (Ministry of Health, 2010c). Such information would be provided to the public by various means such as flyers, brochures, books, DVDs and through television advertisements to improve the public's knowledge about water fluoridation and to clarify the myths regarding it.



*Figure 19 Anti Fluoride Actions*

(Source: Fluoride action network, 2009)

In the current study, 16.1% of participants reported that they did not know the effect of water fluoridation and those people in the communities should be identified and provided with the correct information. It is assumed that it is easier to educate the people who know nothing about fluoridation than those who strongly believe that fluoride causes systemic diseases (7.7% in the current study). The Government could encourage research to investigate the false beliefs about water fluoridation in areas where anti-fluoridation campaigns are actively persisting in New Zealand.

Anti-fluoridation websites could be reviewed and commonly discussed topics may be answered or clarified by the Ministry of Health. For example, on Fluoride Action Network website, opponents have indicated that the Ministry of Health has not reported the adjustment of fluoride according to the temperature regarding water fluoridation in New Zealand (Fluoride action network, 2009). As there is a need to change the level of fluoride in the water according to the local temperature (see table 26) (Shabeel, 2009; Peter, 2001), the Ministry of Health should clearly state the fluoride level in the water according to the temperature. Current information from the Ministry of Health website indicates that fluoride is adjusted between 0.7-1ppm without temperature specific information (Ministry of Health, 2009c).

Hence, opponents of water fluoridation need only sow a seed of doubt to ensure a “no” from the public. At the same time supporters of fluoridation should demonstrate beyond all questions that fluoridation is safe and desirable in order to get a “yes” vote (Peter, 2001).

Table 26

*Adjustment of Fluoride in water according to Temperature (Shabeel, 2009)*

Temperature in degrees Celsius	Fluoride adjustment in water
$\leq 18.3$	1.1 to 1.3
18.9-26.6	0.8 to 1.0
$\geq 26.7$	0.5 to 0.7

## 5. What is the Association between Oral Health Literacy and Attitude towards Water Fluoridation in Christchurch?

The results of the current study indicated that there was a significant association between oral health literacy and parents’ attitude towards water fluoridation. Both raw health literacy scores and modified health literacy scores were associated with parents’ attitudes towards water fluoridation. The parents who received very low oral health literacy scores reported that they do not want fluoridation in Christchurch. At the same time, parents who admitted that they want water fluoridation in Christchurch scored high on oral health literacy, with that T-test results being statistically significant ( $t=2.951$ ,  $df = 91.101$ ;  $p=0.004$ ). This shows that parents who do not want to fluoridate the water supply in Christchurch had a lack of oral health literacy defined as a lack of oral health knowledge and comprehension knowledge.

In the regression analysis, socio demographic variables and parents' attitude to water fluoridation were regressed against raw health literacy scores. A negative association was identified with negative regression coefficient values ( $p < 0.05$ ) for education at high school and lower, Samoan and Indian ethnic groups, and for parents with a family income of less than \$500 and between \$500 and \$1000 per week. New Zealand European ethnic group had a positive significant association with oral health literacy even after including parents' attitudes towards water fluoridation. In the regression model with only socio demographic variables and oral health literacy implies that being a male gender decreases oral health literacy scores. In the second regression model which was developed including parents' attitude towards water fluoridation in the first model (socio-demographic variables alone) showed that being a male is no longer significant which indicated that attitude towards water fluoridation of male parents is same as female parents.

Hence, this result shows that people who do not want water fluoridation also lack oral health literacy and they are mainly in the Samoan and Indian ethnic groups, working in the education sector and are parents with low family income. Hence, more than convincing people to vote "yes" for water fluoridation, a more targeted approach that increases oral health knowledge regarding preventing dental caries and protecting the oral cavity will, potentially result in positive outcomes regarding fluoridating the communities in New Zealand.

The implications and recommendations for improving parents' oral health literacy will be discussed in the next chapter.

## 6. Summary of key Findings

- The developed questionnaire had acceptable validity and reliability.
- The majority of parents had good basic oral health knowledge.
- The female participants and New Zealand Ethnic group were highly represented in the current study.
- The majority of parents were unaware of the importance of cleaning the baby's gum after feeding.
- The majority of parents were unaware of the importance of parent's supervision on children's brushing.
- More than a half of parents were aware of dental caries as a contagious disease.
- 90% of parents had good knowledge about the effect of sugary snacks on dental caries.
- The majority of parents were aware of the amount of fluoride toothpaste to be used for two years old but only few had good knowledge on percentage of fluoride in child's toothpaste.
- More than half of the parents opted for water fluoridation in Christchurch.
- There was strong association present between parents' attitude towards the water fluoridation and their oral health literacy.
- There was an association present between parents' knowledge about the first dental visit and the oral health literacy.

- Generally, comprehension skill was good for majority of parents and there was statistically significant association present with gender and income on bivariate analysis for comprehension knowledge and socio demographic variables.
- Bivariate analysis of oral health knowledge and socio-demographic variables revealed that oral health knowledge was associated with parents' education, ethnicity and the income.
- On average, parents had moderate oral health literacy in the current study.
- Oral health literacy was strongly associated with socio-demographic variables such as ethnicity and the income.

Now the implications and recommendations will be discussed.

## Chapter six: Implications and Recommendations

Although the role of parents' oral health knowledge in improving children's oral health has been demonstrated in many studies as discussed in the literature review, the role of improving children's oral health by improving the parents' oral health literacy, has been less extensively studied in the literature. Improving oral health literacy may be seen as a life long process, as people gain health literacy by knowledge obtained at various stages throughout their lives. The cumulative effects of this process are important as well as using teachable moments, example having preschool aged children. Even though health literacy is considered a challenge, it is not very difficult for a literate person to become health literate. There is more chance of parents losing motivation after health education camps and presentations conducted for few hours or days. But intervention measures undertaken at various stages of a child's life will improve the oral health literacy of parents as well as the child's oral health status. "Most of us become parents long before we have stopped being children" (Mignon McLaughlin, *The Second Neurotic's Notebook*, 1966). The oral health literacy of parents should be developed well before one becomes a parent. Therefore, recommendations for improving oral health literacy will be discussed.

In New Zealand, nearly 99% of people are literate and 29% of New Zealanders hold a tertiary degree. In the current study, the majority of parents had good comprehension knowledge. Because health care information is sometimes difficult to understand, improving oral health literacy by using printed materials such as brochures, flyers and pictograms would be easier when designed in such a way that people can easily understand them. The effect of brochures in improving health literacy was proved in a study by Davis et al. (1998). Perhaps written material with instructions to prevent children's diseases in oral health could be distributed to

the parents starting from well before the child is born, that is during pregnancy. Current results from the study imply that parents with low education, families with low weekly income, immigrants and the indigenous population, have less comprehension knowledge. Therefore, while distributing any printing materials on health information to parents is useful, health care providers may not be aware that the parent does not have ability to understand that information. It is important that health care providers check with the parent whether the information given is understood. Evidence states that accessing an interpreter for service for the non-English speaking population is quite difficult at present in New Zealand. Employing more interpreters could help health care providers to explain health issues to their non-English speaking clients.

## **1. Recommendations for Health Care Providers**

The present study demonstrated that parents were lacking in oral health knowledge regarding both their child's oral health and the child's first dental visit. In the current health system, oral health advice is given mostly by oral health providers and Plunket nurses. Oral health information provided repeatedly by different health care providers may possibly improve parents' awareness of oral health issues and in turn oral health literacy. Therefore, child's primary health care provider giving priority to children's oral health by educating the parents may improve parents' oral health literacy. Parents' level of oral health literacy will then be reflected in the oral health status of children. It is important parents are educated on the link between oral health and general health, by combining the general and oral health services.

The Ministry of Health's strategic vision for oral health in New Zealand states that building linkages between primary health care providers and oral health services are one of the most important actions to improve oral health in children and adolescents (Ministry of Health,



2007). Hence, recommendations are presented for health care providers, including midwives, primary health providers, Plunket nurses and oral health providers. Silk (2010) suggested various stages of approaching parents for intervention for better oral health in children. These consisted of six stages before the child reaches five years of age. By following these stages, the oral health information needed at each stage of the child's life would be provided in order to improve parents' oral health knowledge regarding the child's oral health. The health care providers whom parents have a high chance of meeting at each stage are recommended as the ones able to increase the oral health knowledge relevant to that stage. The information provided to the parents at different stages may be in the form of brochures; by motivational interviewing; or by simple advice. This could be provided to the parents by any method, but the primary aim would be to reduce the parental risk related behaviours regarding the child's oral health and to improve parents' knowledge of preventing oral health diseases.

In the next section, I outline some of the ways in which the types of recommendations I suggested in the discussion section might be implemented. These recommendations are not intended to be exhaustive, but perhaps suggest a model for carving up different types of oral health literacy programmes, and different types of education providers. Immediately below is one possible plan for providing a range of oral health literacy strategies, organised on a chronological basis (ante-natal to school age). Following this is a short discussion on the ways in which each of the key players: Government, policy makers, education providers and media, could take responsibility for a defined, measurable part of the oral health literacy programme.

## **1.2 Prenatal Intervention**

### **(Midwife)**

As noted before, the advice given to pregnant women about good oral health habits is likely to be passed on to their children. Our results suggested that a few parents lack basic oral health knowledge which is required for interpreting and understanding information regarding the child's oral health. Hence, parents' basic knowledge would be improved by providing pictograms or brochures during pregnancy. Parents can be advised by the mid-wife or by the obstetrician to have regular dental visits during pregnancy to avoid transmission of cavity causing bacteria to their child later.

## **1.3 One week, 1 month, 2 months**

### **Mid-wives, Plunket nurses, GPs and oral health providers (if the child is enrolled in the oral health services)**

At this stage parents have many chances to meet the mid-wife (recovering from pregnancy), the Plunket nurse (well-baby visits), and the GP (vaccinations). Hence, it is recommended that those health care providers provide the parents with the necessary oral health information.

The results demonstrated that only a few parents were aware of cleaning the child's gum after feeding, so this knowledge and the effect of using bottles at bed time can be provided at this stage. From the results, many parents were also not aware of pacifier use and the transmission of micro-organisms from mother to child. Hence, health care providers would be able to give information about using pacifiers and the effect of sharing or pretesting food. Parents could be informed about healthy soothing habits because in the current study 20% of parents were not aware of the caries causing effect on using a bottle at bed time. Low weight babies may be

referred to oral health services at an early stage by the paediatrician or mid-wife, as low birth weight babies have many oral health issues including poor enamel (Silk, 2010).

#### **1.4 Four months**

##### **GPs, Plunket nurses and oral health providers (if the child is enrolled in the oral health services)**

In the current study, few parents were not aware of effect of sugar in causing cavities. Parents could be informed about healthy dietary habits at this stage as teeth may soon be erupting. Also parents could be reminded of the cariogenic effect of using a bottle and sipper during bed time. The results of the current study imply that the majority of parents were confused about managing teething. As teeth may start to erupt at this stage, information about teething and managing teething problems can be given at this stage. Parents would be encouraged to monitor teething by providing some special calendar with the general time of eruption indicated in it. As most of the parents in the current study were not aware of the relationship between systemic diseases and delayed eruption of teeth, monitoring teething might help in the diagnosis of systemic diseases at an early stage.

#### **1.5 Six months, 9 months**

##### **Plunket nurses, GPs and oral health providers (if the child is enrolled in the oral health services)**

As using a bottle in preschool aged children has proved to be a major cause of early childhood caries, it is useful for health care providers to find out whether bottles are used in the bed. The child's sugar exposure is identified and parents advised to reduce sugar rich juices and encouraged to use water instead. As a prevention measure, those mothers who are breast

feeding can be advised not to use bottles and the child can go straight to a cup. In the current study, the majority of parents had less knowledge regarding brushing in preschool aged children which implies that parents needed more information regarding this. Hence, parents are advised to start brushing as soon as the teeth erupt, with bed time brushing insisted on owing to the decrease in the protective effect of saliva at night. Parents may be advised to make brushing a part of bedtime rituals: Bath, Bottle/cup, Brush, Book, and Bed (Silk, 2010). A dental visit is advised as soon as the child turns one and if the child is not enrolled in the oral health services, parents may be encouraged by GPs and Plunket nurses to enrol before the child's first birthday.

## **1.6 12 months to 3 years**

### **(Oral health care Providers)**

Parents could be advised to completely stop the bottle and start using cups. Advice on sugar-free diets can be provided and correct brushing techniques taught by oral health providers during dental visits. Depending on the fluoride status of the home town's water supply, advice about the effect and amount of topical fluorides used could be given. In the current study the majority of parents were not aware of the percentage of fluoride in children's tooth paste and the amount of fluoride toothpaste that should be used for children. Parents can be informed about the percentage of fluoride in children's tooth paste to avoid using adult's toothpaste for a child. Parents could be advised to use a smear of a child's fluoridated toothpaste. Children with a high caries risk are identified and additional fluoride supplements prescribed. If needed, dental sealant can be applied. Parents are advised to end the pacifier use and support to end the habit can be given to the parents.

### **1.7 Three years- Five years (Oral health care providers)**

Sugar-free and fibre rich foods should be encouraged. Twice daily tooth brushing under parental supervision (until the child turns 8) is preferable as being ideal. Compulsory dental referrals would be advised to identify and treat dental caries at an early stage to avoid their spread to other teeth.

Health care providers including Plunket nurses, doctors and mid-wives could be educated to provide the above oral health information for clients using short online courses. Also health care providers including oral health providers could be educated about oral health literacy because it is considered an emerging concept.

## **2. Recommendations for Policy Makers**

It is important that the Government and policy makers encourage health care providers to carry out the above mentioned interventions on a systematic and regular basis. The results of current studies imply that parents from low socio-economic communities, indigenous and immigrant populations have low oral health literacy regarding their children's oral health. It would be ideal if government policies concentrated more on these people to improve their oral health literacy for improving oral health outcomes. Rather than creating general policies to cover the community as a whole, policies concentrated on specific population groups such as those in the at-risk population group would be of more benefit. For example, as enrolments of pre-school children from the Maori ethnic group are lower for free oral health services, reminder letters can be sent to those parents at periodic intervals. Another example includes sending birthday cards with information about free oral health services and the need for early enrolment in oral health services, to those children who have not previously enrolled in the oral health services. Evidence indicates that the total cost of dental care for a child doubles if

the first visit does not occur until the child turns age 5 compared to signing up at 1 year of age.

An important issue about government policies is whether the public have an awareness of those policies and whether all services provided by the Government reach all population groups. Although some parents are aware of government services, others for various reasons are not aware of these programmes. Finding a method in which everyone receives the same information is a challenge for the government and health providers, to ensure every parent has the same opportunity in receiving valuable knowledge around oral health.

Most of the parents in the current study were not aware that the first dental visit should be made before the first year and reported that the child should first see a dentist only at school age. Information about the Government's free dental services advertised on national television (as is the case for cervical screening) to improve the awareness of free dental services, would be very effective in informing the parents of this policy. As accessing dental clinics has improved in rural areas by community and mobile dental clinics, parents have been able to be aware of those services. Currently the parents contact the mobile dentist service via their personal mobile phone. An improvement to this successful service could perhaps involve subsidising the costs of using a mobile phone to contact mobile dental services, making it free of cost. This could potentially improve the access to mobile oral health services in the rural areas.

In current oral health brochures distributed by the Government (see Appendix N), oral health information regarding free dental services and other information to improve oral health are available in seven languages (English, Maori, Samoan, Tongan, Tokelauan, Cook Island Maori and Niuean) (Ministry of Health, 2010c). In the current study, the Indian and Chinese population had low comprehension knowledge. Hence, if oral health information were made

available in Chinese and Indian as well it would improve the ability to understand oral health issues.

The current brochure contains all the information needed for the parents except for a few things related to cleaning the baby's gum after feeding; teething and managing teething problems; and specifications about the fluoride content of a child's toothpaste. As this information is considered important for better oral health as discussed before, it would be better if information regarding it was included in such brochures. Also the current brochures are designed commonly for all age groups (0-18 years) (See Appendix Q) and it would be better if they were designed to be more age specific to avoid confusion in parents and include more details relevant to each age group.

The brochure about the free dental service (See Appendix R) has been distributed in private dental and GP clinics, and preschools (Personal communication, Torunn Borsting, 2010). Availability may be improved by distributing those brochures in post-offices, pharmacies and banks so parents get more chance to read the information while waiting. In current brochures, information about brushing and amount of fluoride toothpaste to be used by different age groups is clearly demonstrated using pictures (see Appendix N and O). These brochures are distributed only in community dental clinics (Personal Communication, Torunn Borsting, 2010) and only the parents attending community dental clinics get such information. Access to such important information may be improved by distributing those brochures in GPs, maternity clinics, pre-schools and other health centres. By this way information would be delivered to majority of parents in the community and it may increase parents' awareness on oral health services.

The effects of dental caries such as chances of nutritional deficiencies, spreading nature of dental caries and difficulties in eating after extracting the teeth would be included in the

brochures to improve parents' awareness which will possibly make parents to give more priority to preventing dental caries rather than extracting and filling the teeth.

In the current study, the majority of parents had a lack of knowledge regarding water fluoridation and also there was an association between parents' knowledge and their attitude towards water fluoridation. This implies that campaigns regarding water fluoridation could be improved and water fluoridation could be introduced in Christchurch to reduce inequalities in oral health outcomes. Parents can be educated in oral health camps and classes about water fluoridation held to ensure a "Yes" vote in referenda regarding water fluoridation. Overall the oral health knowledge of parents could be improved to increase the ability to understand the concept of water fluoridation and fluoride action in arresting dental caries. The Ministry of Health has recently introduced a brochure (see Appendix Q) which has quality information about water fluoridation but it is not yet distributed in the Canterbury region (Personal communication, Torunn Borsting, 2010). This brochure could be distributed via health care providers, educational institutes and other major organisations to improve the parents' trust in water fluoridation. Future brochures could include some extra information regarding fluoride's action such as arresting dental caries and bactericidal actions may enhance parents' understanding.

As oral health literacy is identified as being low in lower socio-economic groups, extra care can be provided to children from such groups. This can be carried out by using motivational interviewing techniques with the parents to identify the risk related behaviours and to reduce those behaviours by proper oral health education. This can be provided by their oral health providers who have received training in the use of motivational interviewing techniques.

Improving parents' knowledge on oral health issues would improve the oral health literacy of parents which will reduce oral health diseases in children and improve oral health outcomes.



A future oral health services strategic plan could include improving parents' oral health literacy as an important factor in improving oral health among children. This will possibly reduce the amount of money spent on free oral health services.

### **3. Recommendations for media**

In recent years the media have been considered to be one of the best approaches for reaching people. Radio, television and the internet are considered to be the best media to engage public attention. On New Zealand television, many health programs and dramas have been telecast which have improved the public's health literacy. But it is rare to find programs related to children's health or oral health. In general people lack oral health knowledge compared to general health; hence a media focus on oral health could be an effective way of increasing parental awareness of oral health issues and where to get information, in the same way that recent cervical screening, alcohol, and mental health campaigns seem to have been well received by the community.

New Zealand is one of the countries with highest rate of household internet access in the world (Statistics New Zealand, 2010). Data from the 2001 Census indicates that households containing two children (aged under 15) were the most likely to be connected to the Internet (50 percent) compared to households with out children (Statistics New Zealand, 2004). Hence, parents can be informed about oral health issues through the internet to convey this information. The health websites may be designed in such a way as to attract parents and oral health information provided in easy English for better understanding.

Important simple oral health tips or information about free oral health services can be printed on children's toothpastes, toothbrushes, children's food and drink packaging may also increase parents' exposure to, and therefore understanding of oral health issues.

#### **4. Recommendations for Education Centres**

Pre-schools and schools could be encouraged to follow the policy of “sugar-free lunch boxes”. Also selling sugar rich foods and beverages in the school zone could be banned.

Linking preschools in oral health services is one of the strategies plan proposed by the Ministry of Health (Ministry of Health, 2007). This could be done by preschools through conducting tooth brushing programs in which parents are advised to bring toothbrushes and pastes and brushing would be carried out as a group to motivate one another, and parents would be allowed to discuss the difficulties in brushing their child teeth and other issues regarding tooth brushing. Suggestions for overcoming such difficulties could be provided by preschool teachers thus improving parents’ knowledge of tooth brushing. Preschool staff can be educated by oral health providers and this kind of program could make the child to understand the importance of brushing. Also children’s awareness of brushing and flossing can be improved using tooth brushing rhymes (see Appendix S)

Oral health education could be included in high school subjects as an early intervention to improve children’s knowledge about oral health which helps them to improve their own oral health as well as that of their children in the future.

Medical and dental institutes should train students to know the parents’ ability to understand health care information and to improve their knowledge based on their ability. They could also be trained to involve parents in health care decision making by informed choices. This would possibly improve parents’ involvement and interest in health issues which potentially improve oral health literacy.

## **5. Recommendations for Future Research**

### **Study limitations**

A convenient sample of pre-schools was selected (two schools on the University campus) for this study which meant an increased number of participants with tertiary qualifications. Even though education is not always a strong predictor of oral health literacy, it does play a role. Hence, in future studies sample selection criteria should use randomisation of preschools to avoid this bias.

Our study results would be enhanced if parents' oral health literacy was compared with children's oral health status. Because of the cost of funding, a children's oral health examination did not form part of this study. An important consideration, however, for a study would be secure funding so that oral health literacy and children's oral health status or DMFT rate could be compared, so that the association between parents' level of oral health literacy and children's oral health status can be identified which would help us to understand the reflection of a lack of parents' oral health literacy on a child's oral health.

Ethnicity is considered an important predictor of oral health literacy in the current study, but the number of participants in the New Zealand ethnic group (with high oral health literacy) was exaggerated and other ethnic groups had very low representation. Because this is about measuring oral health literacy, there is less chance for people with low oral health literacy to volunteer to participate in such a survey. Hence, future studies would follow a stratified sampling method that is with an equal number of participants from each ethnic group to achieve results about all ethnic groups in detail.

## **Future Directions**

Future research could concentrate on:

- The effect of current interventions such as campaigns, brochures, oral health websites and other health care materials in improving parents' oral health literacy.
- The effect of early intervention well before pregnancy in improving mothers' oral health literacy regarding the child's oral health.
- The effect of motivational interviewing in improving oral health literacy.
- Identifying the health care providers' perspective of oral health literacy.
- Identifying the current level of awareness among health care providers about improving parents' oral health literacy.
- Identifying a better intervention program to improve the oral health literacy for every parent in the community.
- Finding a better way to involve parents in decision making to enhance their oral health literacy

## Chapter Seven: Conclusions

The oral health literacy of parents is considered to be one of the most important measures in reducing early childhood caries. Our study demonstrated that only a small number of parents have good oral health literacy to protect their child from oral health diseases.

Early childhood caries in non-fluoridated areas can be decreased by improving parents' oral health literacy. The current study has identified the **association between parents' oral health literacy and their attitude towards water fluoridation**. Hence, concentrating more on parents' oral health literacy would be another way of convincing people to accept water fluoridation.

Even though oral health services are provided free of cost for children, the reason for less **enrolment for pre-school** aged children was identified as lack of knowledge among parents regarding the child's first dental visit. More than spending money on improving existing services, improving parents' oral health literacy would help parents to make use of existing services in a competent way.

As in other studies, in the current study the risk population with low oral health literacy is identified as parents from **lower socio-economic groups**; parents with education lower than a university degree and indigenous and immigrant populations. Hence, intervention programs and oral health literacy research should be targeted mostly at those risk groups.

The oral health literacy of parents must be considered an important measure in improving a child's oral health. Hence, it is advisable for policy makers to **consider parents when preventing oral health diseases** such as early childhood caries and for future research to concentrate on the level of health care providers' awareness in improving parents' oral health

literacy. Medical and dental education institutes could train students to be skilful health care providers in understanding parents' knowledge and educating them to form a community with expert parents.

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## Appendices

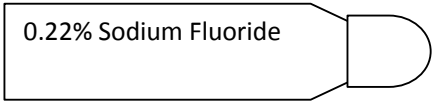
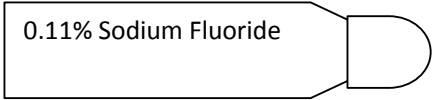
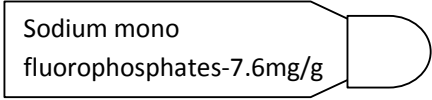
### Appendix A

#### Dental Health Survey

**We would like you to answer some questions about children's oral health. If you need help, please ask.**

**Circle the best answer for each statement. Please choose only ONE answer:**

1. A cavity is:
  - a. A silver filling in a tooth
  - b. A small hole in a tooth
  - c. Sticky coating on the tooth
  - d. Don't know
2. The amount of fluoride toothpaste used for a child that is 2 years or older is:
  - a. Enough to cover the whole toothbrush
  - b. About a smear of toothpaste
  - c. None at all
  - d. Don't know
3. After feeding a baby who has no teeth, his/her gums:
  - a. Should be cleaned with a clean gauze or washcloth
  - b. Do not need to be cleaned
  - c. Should be brushed with a toothbrush
  - d. Don't know
4. Plaque is:
  - a. Left-over food on the teeth
  - b. A cavity
  - c. A sticky film that forms on teeth
  - d. Don't know
5. A dental sealant is:
  - a. Plaque that has hardened on the teeth
  - b. A silver filling
  - c. A coating that protects teeth from cavities
  - d. Don't know
6. Tooth enamel is:
  - a. The hard outer layer of a tooth
  - b. A cavity
  - c. The inside of a tooth
  - d. Don't know

7. The general rule is that when baby teeth start to come in, they should be:
  - a. Left alone
  - b. Cleaned morning and night
  - c. Cleaned once a week
  - d. Don't know
8. Parents/caregivers should brush their child's teeth until:
  - a. The child turns 2 years old
  - b. The child stops taking a bottle
  - c. The child can tie his/her own shoes
  - d. Don't know
9. Putting a child to bed with a bottle of milk:
  - a. can cause cavities
  - b. will never cause cavities
  - c. will help make the child's teeth stronger
  - d. don't know
10. Children should first see a dentist:
  - a. When their adult teeth come in
  - b. By age one
  - c. When they start school
  - d. Don't know
11. Giving children sugary snacks between meals:
  - a. is not really harmful to their teeth
  - b. helps their teeth to grow
  - c. can cause cavities in their baby teeth
  - d. don't know
12. When a mother puts her child's pacifier (dummy) in her mouth to clean it:
  - a. Her mouth germs can help the child get cavities
  - b. Her mouth germs will not pass on to the child
  - c. Her mouth germs will keep the child from getting cavities
  - d. don't know
13. The best fluoride tooth paste for your child is
  - a.  0.22% Sodium Fluoride
  - b.  0.11% Sodium Fluoride
  - c.  Sodium mono fluorophosphates-7.6mg/g
  - d. Don't know
14. The fluoride in drinking water causes

- a. Systemic diseases
  - b. Prevents dental decay when concentration is 1ppm
  - c. Makes teeth brittle and weak
  - d. Don't know
16. Do you think the Christchurch water supply should be fluoridated?
- a. Yes
  - b. No
15. Generally, first teeth appears in the mouth at the age of
- a. 6-7 months of age
  - b. 10-12 months of age
  - c. 1-2 years of age
  - d. don't know
16. The delayed eruption of teeth may be due to:
- a. Systemic diseases
  - b. Breast feeding
  - c. Thumb sucking
  - d. don't know
17. Teething causes
- a. Fever > 38.9 degree
  - b. Desire to bite
  - c. Runny nose
  - d. don't know
18. To manage pain due to teething:
- a. allow nursing or bottle feeding at night
  - b. rub the gum
  - c. allow child to bite chilled object
  - d. Don't know

**Instructions: This is a story about a boy named Sammy. The story will help you to answer some questions. If you need help, please ask.**

Sammy is 20 months old and is at the dentist's office. The dentist tells his mother that Sammy should get a fluoride treatment. He tells her that the fluoride will soak into Sammy's teeth. This will make his teeth stronger so that Sammy can fight future cavities.

The fluoride the dentist puts on Sammy's teeth is stronger than the toothpaste in stores. But, this does not mean his mother should stop brushing Sammy's teeth.

Sammy gets the fluoride treatment. The dentist tells his mother not to give him anything to eat or drink for 30 minutes because the fluoride needs to soak into Sammy's teeth.

**Please use the information in the story to choose whether the statement is true or false.**

<b>Circle True or False for each statement:</b>	<b>True</b>	<b>False</b>
1. The fluoride treatment will help Sammy's to not get cavities.	T	F
2. The fluoride treatment was given to make Sammy's teeth whiter.	T	F
3. Sammy's mother does <u>not</u> have to brush his teeth every day now that he got the fluoride.	T	F
4. It is okay to give Sammy a cracker one hour after he got the fluoride.	T	F
5. It is <u>not</u> okay to give Sammy a sip of water right after he got the fluoride.	T	F
	T	F

**Please tick in the applicable box**



Gender	<input type="checkbox"/> Female <input type="checkbox"/> Male
Age	<input type="checkbox"/> Less than 30 years old <input type="checkbox"/> 30-39 years old <input type="checkbox"/> 40-49 years old <input type="checkbox"/> 50 years old and older
Employment	<input type="checkbox"/> Health sector <input type="checkbox"/> Educational sector <input type="checkbox"/> Other (Please Specify) _____ <input type="checkbox"/> Unemployed
Educational level	<input type="checkbox"/> University <input type="checkbox"/> High school <input type="checkbox"/> Primary school <input type="checkbox"/> Others (Please specify) _____
Family income per month	<input type="checkbox"/> Less than \$500 per week <input type="checkbox"/> \$500-\$1000 per week <input type="checkbox"/> \$1000-\$1500 per week <input type="checkbox"/> More than \$1500 <input type="checkbox"/> Don't know
Ethnicity	<input type="checkbox"/> European New Zealander <input type="checkbox"/> Maori <input type="checkbox"/> Pacific Islander <input type="checkbox"/> Asian (Please specify) _____ <input type="checkbox"/> Others(Please specify) _____
Relationship to the child	<input type="checkbox"/> Mother <input type="checkbox"/> Father <input type="checkbox"/> Step-parent <input type="checkbox"/> Grandmother <input type="checkbox"/> Grandfather <input type="checkbox"/> Aunt <input type="checkbox"/> Foster parent <input type="checkbox"/> Other (please specify)

## Appendix B

### DENTAL HEALTH SURVEY

We would like you to answer some questions about children's oral health. If you need help, please ask.

Circle the best answer for each statement. Please choose only ONE answer:

1. A cavity is:
  - a. a silver filling in a tooth
  - b. a small hole in a tooth
  - c. sticky coating on the tooth
  - d. don't know
2. The amount of fluoride toothpaste used for a child that is 2 years or older is:
  - a. enough to cover the whole toothbrush
  - b. about the size of a pea
  - c. none at all
  - d. don't know
3. After feeding a baby who has no teeth, his/her gums:
  - a. should be cleaned with a clean gauze or washcloth
  - b. do not need to be cleaned
  - c. should be brushed with a toothbrush
  - d. don't know
4. Plaque is:
  - a. left-over food on the teeth
  - b. a cavity
  - c. a sticky film that forms on teeth
  - d. don't know

5. A dental sealant is:
- a. plaque that has hardened on the teeth
  - b. a silver filling
  - c. a coating that protects teeth from cavities
  - d. don't know
6. Tooth enamel is:
- a. the hard outer layer of a tooth
  - b. a cavity
  - c. the inside of a tooth
  - d. don't know
7. The general rule is that when baby teeth start to come in, they should be:
- a. left alone
  - b. cleaned morning and night
  - c. cleaned once a week
  - d. don't know
8. Parents/caregivers should brush their child's teeth until:
- a. the child turns 2 years old
  - b. the child stops taking a bottle
  - c. the child can tie his/her own shoes
  - d. don't know
9. Putting a child to bed with a bottle of milk:
- a. can cause cavities
  - b. will never cause cavities
  - c. will help make the child's teeth stronger
  - d. don't know

- 10.** Children should first see a dentist:
- a.** when their adult teeth come in
  - b.** by age one
  - c.** when they start school
  - d.** don't know
- 11.** Giving children sugary snacks between meals:
- a.** is not really harmful to their teeth
  - b.** helps their teeth to grow
  - c.** can cause cavities in their baby teeth
  - d.** don't know
- 12.** When a mother puts her child's pacifier in her mouth to clean it:
- a.** her mouth germs can help the child get cavities
  - b.** her mouth germs will not pass on to the child
  - c.** her mouth germs will keep the child from getting cavities
  - d.** don't know

**PLEASE CONTINUE TO NEXT PAGE**

**Instructions: This is a story about a boy named Sammy. The story will help you to answer some questions. If you need help, please ask.**

Sammy is 20 months old and is at the dentist's office. The dentist tells his mother that Sammy should get a fluoride treatment. He tells her that the fluoride will soak into Sammy's teeth. This will make his teeth stronger so that Sammy can fight future cavities.

The fluoride the dentist puts on Sammy's teeth is stronger than the toothpaste in stores. But, this does not mean his mother should stop brushing Sammy's teeth.

Sammy gets the fluoride treatment. The dentist tells his mother not to give him anything to eat or drink for 30 minutes because the fluoride needs to soak into Sammy's teeth.

**Please use the information in the story to choose whether the statement is True or False.**

<b>Circle True or False for each statement:</b>	<b>True</b>	<b>False</b>
1. The fluoride treatment will help Sammy's to <u>not</u> get cavities.	<b>T</b>	<b>F</b>
2. The fluoride treatment was given to make Sammy's teeth whiter.	<b>T</b>	<b>F</b>
3. Sammy's mother does <u>not</u> have to brush his teeth every day now that he got the fluoride.	<b>T</b>	<b>F</b>
4. It is okay to give Sammy a cracker one hour after he got the fluoride.	<b>T</b>	<b>F</b>
5. It is <u>not</u> okay to give Sammy a sip of water right after he got the fluoride.	<b>T</b>	<b>F</b>

Read each statement and tell us your opinion by circling a number. If you need help, please ask.

	Strongly Disagree	←	→	Strongly Agree	
1. My child will <u>not</u> get cavities.	1	2	3	4	5
2. There is little benefit in taking a child to the dentist at least once a year.	1	2	3	4	5
3. Asking for help about how to care for my child's teeth is easy for me.	1	2	3	4	5
4. Because I do <u>not</u> like teeth, I do <u>not</u> talk to the doctor/dentist about them.	1	2	3	4	5
5. My child's doctor/dentist expects me to take care of my child's teeth.	1	2	3	4	5
6. Getting cavities is part of a child's growing up.	1	2	3	4	5
7. Using fluoride toothpaste is a good idea.	1	2	3	4	5
8. My family does <u>not</u> understand why I care about my child's teeth.	1	2	3	4	5
9. It is normal for a child to get toothaches.	1	2	3	4	5
10. I do <u>not</u> like asking the doctor/dentist questions about my child's teeth.	1	2	3	4	5
11. There is benefit in brushing my young child's teeth.	1	2	3	4	5
12. The inside of the mouth is gross.	1	2	3	4	5
13. I do <u>not</u> always get what the doctor/dentist is telling me about my child's teeth.	1	2	3	4	5

	Strongly Disagree	←————→			Strongly Agree
14. There is <u>no</u> need for a child to have their teeth brushed every day.	1	2	3	4	5
15. My child will get cavities because he/she has soft teeth.	1	2	3	4	5
16. Others say my child's teeth need to be brushed more often.	1	2	3	4	5
17. I do <u>not</u> know where to get information to learn how to take care of my child's teeth.	1	2	3	4	5
18. Cavities do <u>not</u> run in my family.	1	2	3	4	5
19. Children will get cavities no matter what parents do.	1	2	3	4	5
20. My family/friends think I should have the knowledge and skills to take care of my child's teeth.	1	2	3	4	5
21. I do <u>not</u> have trouble knowing what questions to ask about how to take care of my child's teeth.	1	2	3	4	5
22. A child's dental health is less important than his/her general health.	1	2	3	4	5
23. It is only the dentist's job to keep a child from getting cavities.	1	2	3	4	5
24. I want to learn more about how to take care of my child's teeth.	1	2	3	4	5
25. I know how to show my child how to brush his/her teeth.	1	2	3	4	5
26. Parents should want their child's teeth to be clean.	1	2	3	4	5

	Strongly Disagree	←————→			Strongly Agree
27. It is my job to teach my child how to take care of his/her teeth.	1	2	3	4	5
28. Others expect me to know how to care for my child's teeth.	1	2	3	4	5
29. I do <u>not</u> want to learn more about how to keep my child from getting cavities.	1	2	3	4	5
30. The doctor/dentist understands me when I talk with him/her about my child's teeth.	1	2	3	4	5
31. A person should make time to see the dentist at least once a year.	1	2	3	4	5
32. It is my job to clean my child's teeth every day so that he/she will have a nice smile.	1	2	3	4	5
33. I already know how to keep my child from getting cavities.	1	2	3	4	5
34. I have trouble finding the right words when talking about my child's teeth.	1	2	3	4	5
35. A child with cavities is <u>not</u> completely healthy.	1	2	3	4	5
36. If I help brush my child's teeth twice a day, I can prevent my child from getting cavities.	1	2	3	4	5
37. I do <u>not</u> like talking about teeth.	1	2	3	4	5
38. I know how to teach my child that cavities are bad.	1	2	3	4	5
39. It would be upsetting if my child had a cavity in a baby tooth.	1	2	3	4	5



1. What is your age? \_\_\_\_\_

2. What is your sex? MALE or FEMALE

3. What is your relationship to the child you care for who is under 6 years old?

**Please circle one:**

Mother	Father	Step-parent	Grandmother
Grandfather	Aunt	Foster parent	Other

4. What was the highest grade you completed in school?

**Please circle one:**

Less than High School	High School/ GED	Some College/ Tech School	College Graduate
--------------------------	---------------------	------------------------------	---------------------

5. What is your race?

**Please circle one:**

Black/African American	White (Hispanic)	White (Non-Hispanic)	Native American Indian
Asian/ Pacific Islander	Multi-Racial	Other: _____	

6. Do you consider yourself to be APPALACHIAN or to have APPALACHIAN family roots? YES or NO

7. What are the ages of ALL the children you care for? \_\_\_\_\_

\_\_\_\_\_

**THANK YOU. WE APPRECIATE YOUR HELP WITH OUR SURVEY.**

## Appendix C

Items	Knowledge A1-A12	Comprehension B1-B5	Skill C10, C13, C16, C33, C43	Motivation C5, C25-C27, C31-C32
<b>Internal Consistency</b>				
▪ Cronbach's alpha (test)	0.665	0.404	0.623	0.700
▪ Cronbach's alpha (retest)	0.676	0.286	0.683	0.710
▪ Ave. inter-item correlation (test)	0.147	0.119	0.247	0.318
▪ Ave. inter-item correlation (retest)	0.161	0.051	0.313	0.353
▪ Ave. Spearman-Brown coefficient (test)	0.633 Range: 0.565 – 0.711	0.402 Range: 0.350 – 0.485	0.633 Range: 0.536 – 0.697	0.704 Range: 0.686 – 0.723
▪ Ave. Spearman-Brown coefficient (retest)	0.704 Range: 0.624 – 0.795	0.252 Range: 0.016 – 0.414	0.697 Range: 0.516 – 0.796	0.707 Range: 0.647 – 0.774
<b>Unidimensionality</b>				
▪ Inter-item correlations (test)	40.9% between 0.15 and 0.50. Highest = 0.344. No items with all correlations < 0.15.	40.0% between 0.15 and 0.50. Highest = 0.315. No items with all correlations < 0.15.	60.0% between 0.15 and 0.50. Highest = 0.364. No items with all correlations < 0.15.	93.3% between 0.15 and 0.50. Highest = 0.721. No items with all correlations < 0.15.
▪ Inter-item correlations (retest)	54.5% between 0.15 and 0.50. Highest = 0.415. No items with all correlations < 0.15.	40.0% between 0.15 and 0.50. Highest = 0.280. B3 has all correlations < 0.15.	90.0% between 0.15 and 0.50. Highest = 0.570. No items with all correlations < 0.15.	86.7% between 0.15 and 0.50. Highest = 0.870. No items with all correlations < 0.15.
▪ Corrected item-total correlations (test)	No items with correlations = 0.40	No items with correlations = 0.40	No items with correlations = 0.40	C5, C25, C26, C31 have correlations = 0.40
▪ Corrected item-total correlations (retest)	A9 and A12 have correlations = 0.40	No items with correlations = 0.40	No items with correlations = 0.40	All except C5 have correlations = 0.40

	Knowledge	Comprehension	Skill	Motivation
Items	A1-A12	B1-B5	C10, C13, C16, C33, C43	C5, C25-C27, C31-C32
<b>Test-Retest Reliability</b>				
<ul style="list-style-type: none"> <li>Simple Kappa Statistic</li> </ul>	Range: 0.3137 (A11) – 0.7094 (A1). 4 items have values = 0.60: A1 (0.8094), A4 (0.6600), A6 (0.6481), A10 (0.6010)	Range: -0.0103 (B3) – 0.3708 (B2, B4). No items with values = 0.60.	Range: 0.1849 (C10) – 0.4037 (C33). No items with values = 0.60.	Range: 0.1450 (C25) – 0.3549 (C31). No items with values = 0.60.
<b>Criterion Validity</b>				
<ul style="list-style-type: none"> <li>Correlation: S-TOFHLA<sup>1</sup></li> </ul>	0.490 (p=0.000)	0.404 (p=0.000)	0.347 (p=0.000)	0.316 (p=0.000)
<ul style="list-style-type: none"> <li>ANOVA : education level (F-statistic)</li> </ul>	4.966 (p=0.002)	3.756 (p=0.012)	3.207 (p=0.024)	0.332 (p=0.802)
<b>Discriminant Validity</b>				
<ul style="list-style-type: none"> <li>Correlation: Marlowe-Crowne Scale<sup>2</sup></li> </ul>	0.173 (p=0.011)	0.117 (p=0.087)	0.252 (p=0.000)	0.024 (p=0.024)
<ul style="list-style-type: none"> <li>Correlation: PANAS (Pos. Affect)<sup>2</sup></li> </ul>	0.252 (p=0.000)	0.129 (p=0.071)	0.101 (p=0.165)	0.126 (p=0.060)
<ul style="list-style-type: none"> <li>Correlation: PANAS (Neg. Affect)<sup>2</sup></li> </ul>	-0.198 (p=0.005)	-0.159 (p=0.023)	-0.263 (p=0.000)	-0.238 (p=0.001)
<b>Construct Validity</b>				
<ul style="list-style-type: none"> <li>Unhealthy Behaviors (=36 months)</li> </ul>	-0.35329 (p=0.0006)	-0.04302 (p=0.6839)	-0.32503 (p=0.0018)	-0.11404 (p=0.2791)
✓ Using bottle after 12 months	-0.32963 (p<0.0001)	-0.24579 (p=0.0026)	-0.14314 (p=0.0881)	-0.00268 (p=0.9743)
✓ Using bottle/sippy at bedtime	-0.15693 (p=0.0631)	-0.02465 (p=0.7717)	-0.09430 (p=0.2749)	-0.00511 (p=0.9522)
✓ Sharing eating utensils with child	-0.06770 (p=0.4152)	0.03027 (p=0.7159)	-0.11374 (p=0.1777)	-0.00781 (p=0.9255)
✓ Chewing child's food	-0.10837 (p=0.1898)	-0.06193 (p=0.4546)	-0.18074 (p=0.0308)	-0.12548 (p=0.1299)
✓ Not seeing dentist < 13 months	-0.16265 (p=0.0498)	0.01085 (p=0.8965)	-0.30448 (p=0.0002)	-0.14274 (p=0.0868)
✓ Not cleaning child's teeth = 1/day	-0.08451 (p=0.3448)	-0.06832 (p=0.4454)	-0.03411 (p=0.7091)	-0.10475 (p=0.2431)

	Knowledge	Comprehension	Skill	Motivation
Items	A1-A12	B1-B5	C10, C13, C16, C33, C43	C5, C25-C27, C31-C32
✓ Giving child unhealthy drinks	0.09543 (p=0.2998)	0.03350 (p=0.7165)	-0.09794 (p=0.2956)	0.07029 (p=0.4455)
✓ Using sweet snacks to behave	-0.35329 (p=0.0006)	-0.04302 (p=0.6839)	-0.32503 (p=0.0018)	-0.11404 (p=0.2791)
✓ Using sweet snacks as reward	-0.07372 (p=0.3749)	0.07679 (p=0.3552)	-0.12824 (p=0.1269)	0.03578 (p=0.6692)
✓ Not giving child own toothbrush	0.04114 (p=0.6195)	0.10089 (p=0.2225)	0.11105 (p=0.1867)	0.07299 (p=0.3796)
✓ Giving child desert food snacks	-0.34850 (p<.0001)	-0.01547 (p=0.8597)	-0.05971 (p=0.4998)	-0.05824 (p=0.5055)
✓ Giving child desert drink snacks	0.10817 (p=0.2083)	0.08125 (p=0.3452)	-0.00998 (p=0.9089)	0.18359 (p=0.0318)

<sup>1</sup> Based on 1-tailed test

<sup>2</sup> Base on 2-tailed test

Robert L. Ludke, Ph.D.  
 Institute for the Study of Health  
 University of Cincinnati Academic Health Center  
 June 13, 2008

## Appendix D

Arthi,

You have permission to use our dental health literacy questionnaire as long as you give proper credit in all dissemination activities. The questionnaire was developed by Ludke RL, Kudel E, and Weber DL, Department of Public Health Sciences, University of Cincinnati, Cincinnati, OH under a grant number R03 DE017089 from the National Institute for Dental and Craniofacial Research, U.S. Department of Health and Human Services. The questionnaire has been validated. We would appreciate you sharing your results with us when you have completed your research. Best wishes.

*Bob*

Robert L. Ludke, Ph.D.

Professor, Department of Family and Community Medicine and

Department of Public Health Sciences

University of Cincinnati Academic Health Centre

PO Box 670840

Cincinnati, Ohio 45267-0840

Phone: (513) 558-2757

Fax: (513) 558-2744

E-mail: Robert.Ludke@uc.edu

Campus location: 260 Stetson Street, Suite 4000

## Appendix E

RE: Thank you- Oral health literacy instrument

**From:**  
"Ludke, Robert (ludkerl)" <LUDKERL@UCMAIL.UC.EDU>  
[Add sender to Contacts](#)  
**To:**  
"arthi veerasamy" <veearthi3@yahoo.co.in>

Arthi,

You have permission to make the indicated changes. Best wishes.

*Bob*

Robert L. Ludke, Ph.D.

Professor, Department of Family and Community Medicine and

Department of Public Health Sciences

University of Cincinnati Academic Health Center

PO Box 670840

Cincinnati, Ohio 45267-0840

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Fax: (513) 558-2744

E-mail: Robert.Ludke@uc.edu

Campus location: 260 Stetson Street, Suite 4000

## Appendix F

Ref: 2010/03/LR-ERHEC

12 August 2010

Arthi Veerasamy

Health Sciences Centre

UNIVERSITY OF CANTERBURY

Dear Arthi

Thank you for forwarding to the Educational Research Human Ethics Committee a copy of the low risk application you have recently made for your research proposal "Oral health literacy of parents of preschoolers".

I am pleased to advise that this application has been reviewed and I confirm support of the Department's approval for this project.

With best wishes for your project.

Yours sincerely

**Dr Mere Skerrett and Nicola Surtees**

***Co-Chairs***

**Education Research Human Ethics Committee**

## Appendix G

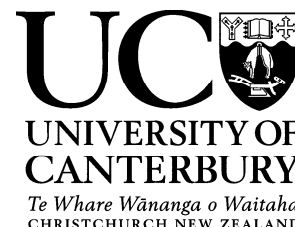
### Parent/Caregiver Information Sheet

---

#### Health Sciences Centre

Tel: +64 3 3667 001 ext. 8362, Fax: + 64 3 364 2490

Email: [healthsciences@canterbury.ac.nz](mailto:healthsciences@canterbury.ac.nz)



## PARENT/ CAREGIVER INFORMATION LEAFLET

<b>Oral health literacy of parents of preschoolers</b>
--

*Principal investigator:* Dr Arthi Veerasamy, Health Science Centre/University of Canterbury, phone 03-3 667 001 ext. 8691 at the University. E-mail: [ave24@uclive.ac.nz](mailto:ave24@uclive.ac.nz)

*Supervisors of the study:* Dr Ray Kirk, Director of the Health Science Centre, phone 03-364-3108, Dr Arindam Basu, phone 03-3458161, ext 44161, Health Science Centre, University of Canterbury, Private Bag 4800, Christchurch.

- The University of Canterbury is conducting a study to find out about level of oral health literacy among parents.
- This study will include completing a survey questionnaire.



- We would like you to help us to find out about the level of oral health literacy of parents by taking part in this study.
- You do not have to take part if you prefer not to.

Please take your time to read this information sheet carefully.

If you decide to participate, we will be very grateful for your contribution to better understanding of oral health literacy and its importance. If you decide not to participate, there will be no disadvantage to you and we thank you for considering our request.

**1. What is the aim of this study?**

Aim of this study is to find the level of oral health literacy of parents of children regarding their child's oral health.

**2. Who can participate?**

People can enter the study if they attend a community dental clinic in Ashburton.

**3. How many participants will be involved?**

We hope that 400-500 parents/caregivers will complete our survey

**4. What is your participation?**

Your participation is voluntary and you are free to withdraw from the study at anytime without having to give a reason. There will be no disadvantage to you. **Your name and personal details are strictly confidential and will not be mentioned in the final report.** If you decide to participate, you will be asked to sign a consent form when you confirm your willingness to be involved.

**5. Where will the survey completed?**

The survey can be completed while you are completed while you are waiting at the community oral health clinic.

**6. What questions will you be asked?**

You will be asked for unidentifiable (**no name**) information about your knowledge and attitude's regarding your child's oral health. This should take about 15-20 minutes maximum to answer.

**7. What will happen to the information?**

Every participant will be identified with a study number (no name will be used). All the information will be kept at the Health Sciences Centre/University of Canterbury. Only the researcher and two supervisors will have access to it to enable your answers to be analysed.

**8. What are the risks and the benefits of the study?**

There is no risk to you as a participant. If there are some questions you do not want to answer, you are free not to answer. The benefit of the study is that your information can help to provide better oral health services for your children.

**9. What will happen to the results of the study?**

It is expected that the final writing of the research will be done by the end of 2010. You will receive a copy of the summary of the final report if you wish.

**10. Who pays for the research?**

The study is financed by the University of Canterbury.

**11. Who has reviewed the study?**

This study has received ethical approval from the College of Education, University of Canterbury.

**12. Where can you receive more information?**

You can request more detailed information from the Principal researcher – Dr. Arthi Veerasamy, Health Science Centre/University of Canterbury, phone 03-3 667 001 ext. 8691 at the University. E-mail: [ave24@uclive.ac.nz](mailto:ave24@uclive.ac.nz)

If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact an independent Health and Disability Advocate, as follows: South Island 0800 377 766 Free Fax (NZ wide) 0800 2787 7678 (0800 2 SUPPORT). E-mail: [advocacy@hdc.org.nz](mailto:advocacy@hdc.org.nz)

**Thank you for considering taking part in this study and for taking time to read this  
Information sheet.**

## Appendix H

### Parent/Caregiver Consent Form

---

**Health Sciences Centre**

Tel: +64 3 364 2987, Fax: + 64 3 364 2490

Email: healthsciences@canterbury.ac.nz



---

## PARENT/ CAREGIVER CONSENT FORM

**For the study**

### **“Oral health literacy of parents of preschoolers”**

Please tick to confirm.

- € I have read and understand the information sheet for the above research study dated 7<sup>th</sup> July 2010.
- € I have had the opportunity to ask questions about the research study, and to discuss it with family and friends and have had time to consider whether to take part.
- € I understand the purpose of the research study, and how I will be involved.
- € I understand that taking part in the study is voluntary (my choice) and I understood that I may withdraw from it, at any time and for any reason.

€ I understand that my participation in this study is confidential and that my name and personal details will not be included in the report.

€ I wish to receive a summary of the study's results.

I \_\_\_\_\_ (please print full name) consent to take part in the  
above research study.

Signed [Parent/Caregiver]

\_\_\_\_\_ Date \_\_\_\_\_

Person taking consent/Researcher

\_\_\_\_\_ Date \_\_\_\_\_

This study is being conducted by Dr Arthi Veerasamy, Master's student through the University of Canterbury/ Christchurch.

You can contact Arthi Veerasamy at the University: 03-3667001, ext: 8691

E-Mail address: ave24@uclive.ac.nz

---

**Supervision:** This project is being undertaken under University of Canterbury Health Sciences Centre supervision.

Supervisors:

- Dr. Ray Kirk, Director of the Health Sciences Centre.(Ph .364 3108)
  - Dr.Arindam Basu, Senior Lecturer in Health Sciences,(Ph.o3 3458161,ext44161)
-

## Appendix I

*Frequency of responses for the items in the questionnaire.*

Question	Possible Responses	Number of person	Percentage
1.A cavity is			
	A silver filling in a tooth	1	0.9
	A small hole in a tooth	113	96.6
	Sticky coating on the tooth	1	0.9
	Don't know	2	1.7
2. The amount of fluoride toothpaste used for a child that is 2 years or older			
	Enough to cover the whole toothbrush	12	10.3
	About of smear of toothpaste	102	87.2
	None at all	0	0
	Don't know	3	2.6
3. After feeding a baby who has no teeth, his/her gums			
	Should be cleaned with a clean gauze or wash cloth	54	46.2
	Do not need to be	46	39.3

	cleaned		
	Should be brushed with toothbrush	3	3
	Don't know	14	12.0
4. Plaque is			
	Left-over food on teeth	11	9.4
	A cavity	2	1.7
	A sticky film that forms on teeth	98	83.8
	Don't know	6	5.1
5. A dental sealant is			
	Plaque that has hardened on the teeth	2	1.7
	A silver filling	5	4.3
	A coating that protects teeth from cavities	93	79.5
	Don't know	17	14.5
6. Tooth enamel is			
	The hard outer layer of a tooth	106	90.6
	A cavity	0	0
	The inside of a tooth	4	3.4
	Don't know	7	6.0
7. The general rule is that when baby teeth start to come in, they should be			



	Left alone	15	12.8
	Cleaned morning and night	87	74.4
	Cleaned once a week	8	6.8
	Don't know	7	6.0
8. Parents/caregivers should brush their child's teeth until			
	The child turns 2 years old	43	36.8
	The child stops taking a bottle	7	6.0
	The child can tie his/her own shoes	49	41.9
	Don't know	18	15.4
9. Putting a child to bed with a bottle of milk			
	Can cause cavities	94	80.3
	Will never cause cavities	3	2.6
	Will help make child's teeth stronger	2	1.7
	Don't know	18	15.4
10. Children should first see a dentist			
	When their adult teeth come in	3	2.6
	By age one	71	60.7
	When they start school	34	29.1

	Don't know	9	7.7
11. Giving children sugary snacks between meals			
	Is not really harmful to their teeth	7	6.0
	Helps their teeth to grow	0	0
	Can cause cavities in their baby teeth	105	89.7
	Don't know	5	4.3
12. when a mother puts her child's pacifier in her mouth to clean it			
	Her mouth germs can help the child get cavities	71	60.7
	Her mouth germs will not pass on to child	8	6.8
	Her mouth germs will keep the child from getting cavities	1	0.9
	Don't know	37	31.6
13. The best fluoride toothpaste for your child			
	0.22% sodium fluoride	23	19.7
	0.11% Sodium Fluoride	23	19.7
	Sodium mono	11	9.4

	fluorophosphates- 7.6mg/g		
	Don't know	60	51.3
14.The fluoride in drinking water causes			
	Systemic diseases	9	7.7
	Prevents dental decay when concentration is 1ppm	86	73.5
	Makes teeth brittle and weak	2	1.7
	Don't know	19	16.2
	Systemic diseases and prevents dental decay when concentration is 1ppm	1	0.9
15. Do you think the Christchurch water supply should be fluoridated?			
	yes	66	56.4
	No	51	43.6
16. Generally, the first teeth appears in the mouth at the age of			
	6-7 months of age	94	80.3
	10-12 months of age	16	13.7
	1-2 years of age	4	3.4
	Don't know	3	2.6

17. The delayed eruption of teeth may be due to			
	Systemic diseases	21	17.9
	Breast feeding	8	6.8
	Thumb sucking	14	12.0
	Don't know	74	63.2
18. Teething causes			
	Fever>38.9degrees	16	13.7
	Desire to bite	76	65.0
	Runny nose	9	7.7
	Don't know	4	3.4
	Fever and desire to bite	3	2.6
	Fever, desire to bite and runny nose	9	7.7
19. To manage pain due to teething			
	Allow nursing or bottle feeding in the night	2	1.7
	Rub the gum	14	12.0
	Allow child to bite chilled object	91	77.8
	Don't know	6	5.1
	Allow nursing or bottle feeding in the night and rub the gum	1	0.9
	Allow child to bite chilled object and rub	3	2.6

	the gum		
20. The fluoride treatment will help Sammy's teeth to not get cavities.			
	True	102	87.2
	False	15	12.8
21. The fluoride treatment was given to make Sammy's teeth whiter			
	True	4	3.4
	False	113	96.6
22. Sammy's mother does not have to brush his teeth every day now that he got the fluoride			
	True	5	4.3
	False	112	95.7
23. It is okay to give Sammy a cracker one hour after he got the fluoride.			
	True	112	95.7
	False	5	4.3
24. It is not okay to give Sammy a sip of water right after he got the fluoride			
	True	105	89.7
	False	12	10.3

## Appendix J

***Health authorities now advise that infants avoid ingesting fluoridated water; overexposure to fluoride puts infants at risk of developing dental fluorosis, a white or brownish scarring of the tooth enamel.***

### American Authorities Issue Fluoride Warning for Infants



#### References

- (1) [http://www.ada.org/prof/resources/pubs/epubs/egram/egram\\_061102.pdf](http://www.ada.org/prof/resources/pubs/epubs/egram/egram_061102.pdf);  
[http://www.cdc.gov/80/fluoridation/safety/infant\\_formula.htm](http://www.cdc.gov/80/fluoridation/safety/infant_formula.htm)  
  
Dental fluorosis pictures:  
<http://www.fluorideaction.org/dental-fluorosis.htm>
- (2) <http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5403a1.htm>
- (3) <http://aappolicy.appublications.org/cgi/content/abstract/pediatrics;115/2/496>  
  
<http://www.egd.org/consumer/topics/baby/fluoride.asp>
- (4) [http://dels.nes.edu/dels/rpt\\_briefs/fluoride\\_brief\\_final.pdf](http://dels.nes.edu/dels/rpt_briefs/fluoride_brief_final.pdf)
- (5) [http://books.nap.edu/nap-cgi/skim.cgi?recid=11571&chap=23-88\\_p33](http://books.nap.edu/nap-cgi/skim.cgi?recid=11571&chap=23-88_p33)
- (6) <http://ewg.org/issues/fluoride/20060322/index.php>
- (7) Dr. Hardy Limebeck, BSc, PhD, DDS, Associate Professor and Head, Preventive Dentistry, University of Toronto
- (8) <http://www.canada.com/s80/saskatoon/news/story.html?id=3ac13c57-80cc-4ddf-bb26-58d592a63014&k=95961>
- (9) [http://www.mothering.com/actions/news\\_bulletins/november2006.html#fluoride](http://www.mothering.com/actions/news_bulletins/november2006.html#fluoride)
- (10) <http://www.nurserywater.com/home.html>

- ◆ In an attempt to prevent dental fluorosis in children, the American Dental Association (ADA) recently joined the Centers for Disease Control (CDC) in advising that fluoridated water not be used in infant formula or foods. (1). According to the CDC, 32% of American children have dental fluorosis, a significant increase from 23% in the 1980s (2).
- ◆ The Academy of Pediatrics and the Academy of General Dentistry have also cautioned parents to avoid fluoridated water when making infant foods (3).
- ◆ The National Research Council stated that on a per-body-weight basis, infants and young children ingesting fluoridated water have approximately three to four times greater exposure than adults (4).
- ◆ Fluoridated water (1 ppm) has 250 times more fluoride than occurs naturally in human breast milk (.004pm) (5).
- ◆ The Environmental Working Group, a public interest watchdog group, analyzed government data in March, 2006, and found that babies are over-exposed to fluoride in most major U.S. cities. In Seattle, almost 45% of formula-fed infants are over the safe fluoride exposure level (6).
- ◆ Dental fluorosis indicates fluoride toxicity and, according to a prominent dental researcher, "it is illogical to assume that tooth enamel is the only tissue affected by low daily doses of fluoride ingestion" (7).
- ◆ In November, 2006, the respected medical journal Lancet described fluoride as an "emerging neurotoxic substance" due to evidence linking fluoride to lower IQs in children, and brain damage in animals (8).
- ◆ Mothering Magazine, November, 2006, published "New Fluoride Warning for Infants" (9).
- ◆ Common household water filters do not remove fluoride; and unlike chlorine, fluoride does not steam off when water is boiled.
- ◆ This warning applies to all fluoridated water in New Zealand.

**For more information contact Fluoride Action Network New Zealand  
[www.fannz.org.nz](http://www.fannz.org.nz) • [www.slweb.org](http://www.slweb.org) • [www.fluorideaction.org](http://www.fluorideaction.org)**

## Appendix K

### WOULD YOU DRINK TOXIC WASTE?

This product is **so toxic it is not allowed to be dumped into land, air or sea.**

But you are encouraged to drink it diluted through your water supply!



Fluoride used for fluoridation:

- ♦ is a toxic waste product of the phosphate fertiliser industry,
- ♦ is not food grade.
- ♦ is contaminated with Mercury, Arsenic, Lead, Cadmium and other heavy metals.
- ♦ is not the same as naturally occurring Calcium Fluoride.
- ♦ has **NEVER** been tested for human safety.

Some of this product comes from Belgium. Belgium won't permit fluoridation of its own water supplies and has banned the sale of fluoride supplements as a threat to health.

**"There is more evidence against fluoridation than there was against DDT when it was banned!"**

- The US Environment Working Group 2005.

**The US National Research Council could find no safe level of fluoride in water (2006).**

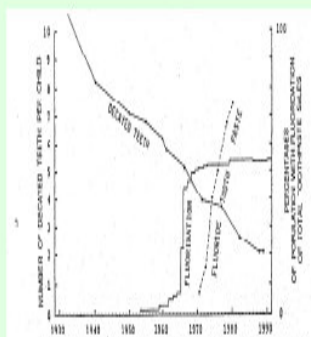
**If in Doubt Leave Fluoride Out!**

Health information sheet 1 of 3.  
Contact FANNZ [www.fannz.org.nz](http://www.fannz.org.nz); PO Box 9804 Marion Square, Wellington

### FLUORIDATION—COLLAPSE OF A FANTASY

- ♦ The latest internationally recognised research (Australia, 2004) showed **ZERO** benefit to the permanent teeth from fluoridation.
- ♦ Timaru stopped fluoridation in 1985. Tooth decay fell from 3.75 to 1.63 by 2004 - less decay than any fluoridated South Island community.
- ♦ The 2004 South Island figures are **1.79** decayed missing or filled teeth (DMFT) in the **fluoridated areas** but only **1.62** in **unfluoridated areas**.
- ♦ **Why:** After 50 years does unfluoridated Napier still has less tooth decay than fluoridated Hastings ?!
- ♦ The Ministry of Health's own statistics confirm that there is no statistically or clinically significant difference in tooth decay in 12 year olds between fluoridated and unfluoridated NZ communities.
- ♦ The NZ dental Journal published a study in 1998 showing no significant difference in dental health where water was fluoridated AND that dental health had improved at the same rate in both fluoridated and unfluoridated areas since 1985.
- ♦ WHO recommend comparisons on 12 year olds as there is well-documented evidence that water fluoridation delays tooth eruption. Thus decay statistics for 5-or-6-year olds as used by promoters instead to show an illusory "benefit" that disappears by age 12.

### Steady improvement in NZ dental health -



50-year decline in tooth decay of 5-year-olds, showing steady drop in decay rates long before fluoridation. (Compiled from Health Department records)

### WOULD YOU SACRIFICE YOUR SON'S LIFE TO CANCER BECAUSE SOME PEOPLE WON'T BRUSH THEIR TEETH?

Equating a child's death to osteosarcoma (bone cancer) with kids maybe having 1/2 a cavity less, there's no comparison.



Seth Valentine, died at 17 from osteosarcoma - an 85% chance it was caused by water fluoridation.



Tony Valentine, Seth's father.

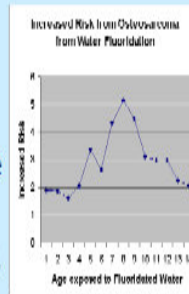
### We trusted the local government's decision to fluoridate the water - that leaves a real knot in your stomach

- Seth Valentine

- ♦ In May 2006 Dr Elise Bassin's research report revealed that boys (but not girls) who drank fluoridated water at age 6 to 10 were 500% to 700% more likely to develop osteosarcoma (bone cancer) in their later teens.

- ♦ This confirmed a similar result found by the New Jersey Health Department 10 years previously.

- ♦ No other study has contradicted these findings. All studies cited by promoters looked at fluoride exposure at the time of diagnosis or random exposure. These are irrelevant.



**Fluoridation—its not worth the risk!**



## Appendix L

---

### Do You Have Unexplained White, Yellow, or Brown Spots on Your Teeth?



Mild Dental Fluorosis



Moderate Dental Fluorosis



Moderate to Severe Dental Fluorosis

These markings are the visible signs of fluoride poisoning, caused by exposure to fluoride from city water and toothpastes. This is not merely a "cosmetic" effect. *What's it done to the rest of your body?*

We invite you to learn how this affects yourself, your children, and loved ones. We are working to end harm from fluoridation.

Please visit our website or call us!



## Appendix M

### DON'T SPIKE OUR DRINKS

Especially not Baby's



The American Dental Association and the US Public Health Services' Centers for Disease Control advise that fluoridated tap water is not safe for babies. According to the NZ Ministry of Health web site nearly half of children living in fluoridated areas have some form of dental fluorosis. This is a mottling or discolouring of the teeth and is caused when a child has had too much fluoride. It is the first outward sign of fluoride poisoning.



Mild dental fluorosis

Babies drinking fluoridated water will be getting up to **250 times** more fluoride than breast fed babies.

### Fluoride is Harmful to Health

Fluoride is now linked to:

- LOWERED IQ
- CANCER
- ARTHRITIS
- ATTENTION DEFICIT AND HYPERACTIVITY DISORDER
- THYROID DISEASE
- LOWERED IMMUNE SYSTEM
- SEVERE ALLERGIC REACTIONS

Did you know?

- Almost all of Western Europe has rejected water fluoridation
- Fluoride is not a nutrient
- Fluoride is not added to water to improve water quality
- Fluoride is a uniquely potent enzyme poison
- Fluoride is slightly more toxic than lead and slightly less toxic than arsenic
- Fluoride concentrates with boiling

Do you realise fluoridation is:

- Mass medication in uncontrolled doses
- Unethical, with no informed choice
- Tantamount to spiking our drink
- Unproven, untested and never registered as safe by any health authority

### Strong Evidence Fluoride Causes Bone Cancer in Young Men

A new study published in "Cancer Causes and Control, May 2006" gives strong evidence that boys exposed to fluoridated water between the ages of 6 and 10 years are 500% to 700% more likely to get bone cancer before age 20 than boys drinking non-fluoridated water.



### WATER FLUORIDATION IS TOXIC WASTE DISPOSAL

Water fluoridation is the addition of the chemical fluoride in the form of hydrofluorosilicic acid or sodiumsilicofluoride. These are toxic by-products of the phosphate fertilizer industry. They are too toxic to be discharged into the air or dumped into the sea or rivers. However, they are allowed to get rid of this waste product if they dilute it into huge amounts of water. Our public drinking water is essentially being used as a toxic waste disposal system.

## Appendix N



MINISTRY OF  
HEALTH  
Akoranga Whakapapa

IT'S EASY TO  
PROTECT  
YOUR FAMILY'S  
SMILE

IT'S FREE, IT'S EASY, IT'S FOR YOU!

let's  
talk  
teeth

CALL  
**0800 TALK TEETH**  
(0800 825 583) [www.letstalkteeth.co.nz](http://www.letstalkteeth.co.nz)



02

let's  
talk  
teeth



Copyright © 2009 Ministry of Health.  
It's Easy To Probe Your Family's Smile.

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 MINISTRY OF  
HEALTH  
MAORI O TE HOKI

# HOW TO GIVE YOUR CHILD A HEALTHY SMILE

We all want to give our children the best start in life. We want them to grow, develop and thrive. Healthy teeth play an important role in a child's development, helping them to eat and speak properly. Nice teeth are important for self confidence later in life.

In this booklet you will find facts and advice on how to look after your child's teeth and protect their smile – for life. So please take five minutes to read the information and find out about oral health. If you have any questions or need help, just talk to us on 0800 Talk Teeth (0800 825 583).

## CONTENTS

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LOOKING AFTER YOUR CHILD'S TEETH	06
FIVE TIPS FOR A HEALTHY SMILE	07
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HEALTHY FOOD. HEALTHY TEETH	09



04

# AT YOUR SERVICE

## THE SERVICE IS FREE

Children in New Zealand are entitled to free basic oral health services from 0 to 17 years of age, until their 18th birthday. It's important to enrol your child as early as possible into the service, so that you can arrange the first check-up. Your child's first visit will usually be between their 1st and 2nd birthdays. Dental staff will let you know the timing of your appointment once you enrol.

It's easy to enrol, just call 0800 Talk Teeth (0800 825 583). We will guide you through it and send out the right forms for you to fill in. If your child is a preschooler or at primary school, fill in the forms and post them to your local oral health service. If you are unsure where this is, call us or visit [www.letsalkteeth.co.nz](http://www.letsalkteeth.co.nz).

If your child is in year 9 or above, you can choose your dentist. Simply fill in the forms and give them to your chosen dental practice.

If your dentist does not have a contract with your local District Health Board, call 0800 Talk Teeth and we will help you find a dentist near you who does.

## TEETH TUNE-UP

Standard treatments are free and include:

- Check-ups involve a routine examination, checking teeth for decay and looking at gums and mouth for any problems.
- X-rays are used to find tooth decay and other problems that can't be seen.
- Fluoride treatment helps make the surface of the teeth more resistant to decay.
- Fissure sealants are a thin layer of white filling, painted onto teeth that are at risk of developing tooth decay.
- Cleaning removes plaque, staining and tartar from teeth.
- Fillings are used to restore teeth that have been affected by tooth decay.
- Extractions to remove teeth that have been badly affected by tooth decay.

## REFERRAL FOR EXTRA TREATMENTS

If your child needs extra treatments, you will be referred to another oral health service provider. Many treatments will still be free, but you will need to pay for treatments such as orthodontics (which includes braces on teeth). Talk to your local oral health service about the costs and payment options.

## KEEP CHECKING

Don't wait for teeth problems; take your child for regular check-ups. Your dental therapist or dentist will let you know how often you need to take your child. Dental check-ups for young children mean problems are recognised and treated early. Try to get an appointment for a time when your child is not tired, and always be positive about dental visits. Use positive language such as "keeping your teeth healthy" and "keeping your smile beautiful".

**GET INTO  
ORAL HEALTH**  
*It's easy. It's free.  
And it's never  
too late to enrol  
your child.*



# FLUORIDE VS PLAQUE

## PLAQUE: THE DIRTY STORY

Plaque is the sticky, soft layer that forms on teeth every day. If left to build up, plaque causes tooth decay and gum disease. Bacteria in plaque reacts with sugar to produce an acid that dissolves the minerals in teeth; over time this causes cavities (holes).

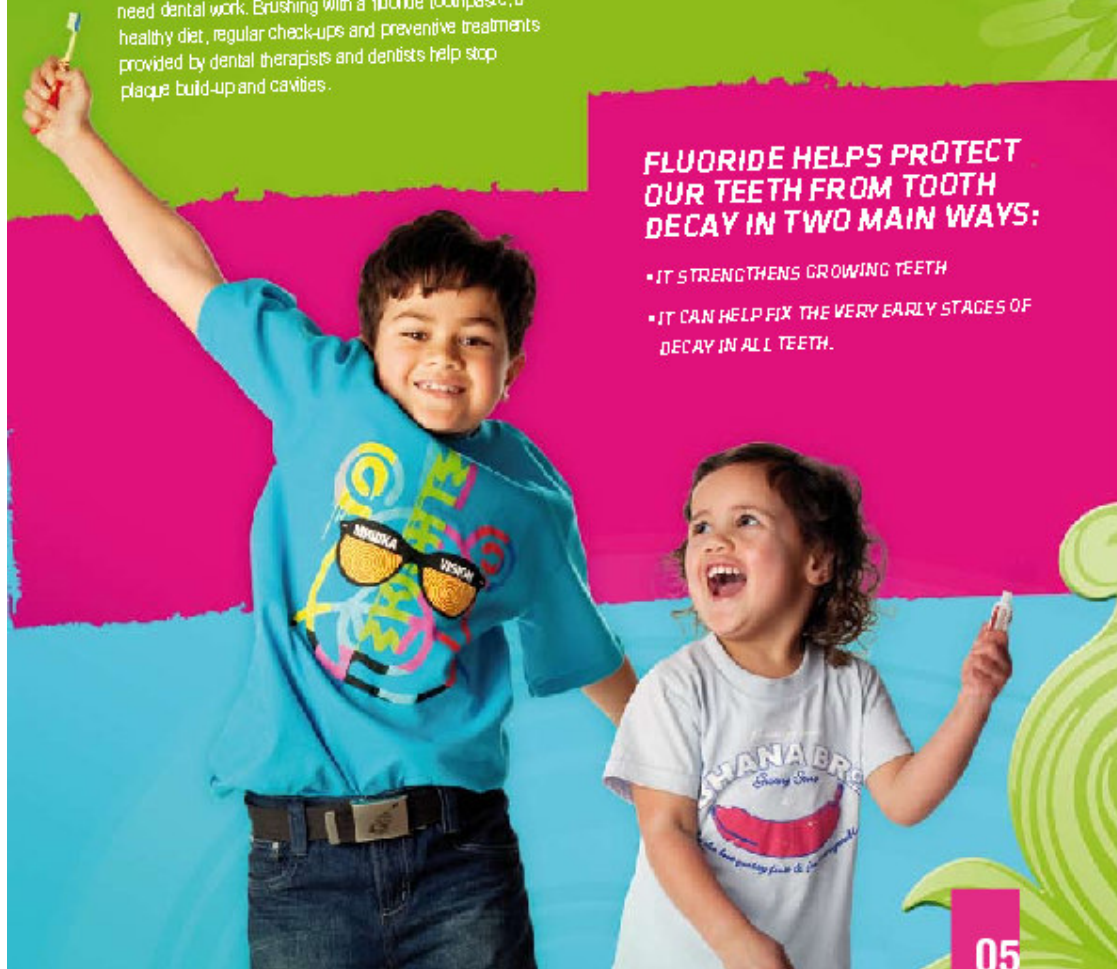
Cavities can cause pain and discomfort and will eventually need dental work. Brushing with a fluoride toothpaste, a healthy diet, regular check-ups and preventive treatments provided by dental therapists and dentists help stop plaque build-up and cavities.

## PROTECTING OUR TEETH

Fluoride is an important weapon in the war against plaque. It is a natural element found in air, soil, fresh water, sea water, plants and lots of foods. Most of the fluoride we eat or drink comes from water, food and toothpaste. Fluoride in food, drink and our saliva continually washes over the teeth to help protect them.

## FLUORIDE HELPS PROTECT OUR TEETH FROM TOOTH DECAY IN TWO MAIN WAYS:

- IT STRENGTHENS GROWING TEETH
- IT CAN HELP FIX THE VERY EARLY STAGES OF DECAY IN ALL TEETH.





06

# LOOKING AFTER YOUR CHILD'S TEETH

Regular brushing helps you look and feel good, and also helps prevent decay and gum disease. As soon as your child's teeth start to show, start brushing. Get your child into the habit of brushing twice a day – after breakfast and before bed. Once a child can control a pencil and begins to write (at around age five), they should be able to brush their own teeth. You'll need to supervise brushing until your child is about eight years old.



## HOW TO BRUSH

As soon as your child has teeth, they should be brushed. Use just a smear of fluoride toothpaste on a small, soft toothbrush for a child under six years and a pea-sized amount for a child six years and over. It can be difficult to brush your toddler's teeth, but keep trying because healthy teeth are important to your child's development and for the future health of their permanent teeth. You may find it easier to stand behind your child and gently tilt their head back as you brush.



## INSIDE AND OUT

Brush all around the inside surfaces, where teeth meet gums, and also the top chewing surfaces. On the front of the teeth, use tiny circles all around the outside surfaces, close to the gums.



## SPIT, DON'T RINSE

Remember to teach your child to spit out after tooth brushing. Do not rinse with water, because a small amount of fluoride toothpaste left around the teeth will help protect them.



## GET FLOSSING

Flossing cleans away plaque and bits of food from between your teeth and below the gum line. It gets to places your brush can't reach. A child should start flossing when two teeth touch. This usually happens when the first back teeth appear. To begin with, you will have to floss your child's teeth, but they will eventually learn to do it for themselves. Floss once a day. If you are not sure how to floss, talk to your dental professional or talk to us on 0800 Talk Teeth (0800 825 583).



## CHECKING TEETH

Gently lift your child's top lip once a month to check inside their mouth. It's a quick and easy way to see whether decay is present in its early, treatable stages. Look for white spots at the gumline, particularly on the upper front teeth. Also look for discoloured areas or pieces of missing teeth. Check that gums look healthy, not puffy or bleeding. Visit your dental professional if you have any concerns. Just call 0800 Talk Teeth (0800 825 583) if you're unsure what to do next.

## FIVE TIPS FOR A HEALTHY SMILE

- 1 BRUSH TWICE A DAY WITH A FLUORIDE TOOTHPASTE.
- 2 HAVE REGULAR DENTAL CHECK-UPS.
- 3 LIFT THE LIP EVERY MONTH AND CHECK YOUR CHILD'S TEETH AND GUMS.
- 4 CHOOSE HEALTHY SNACKS.
- 5 DRINK WATER OR MILK.

### BE POSITIVE

*Don't forget to praise your child for cleaning their teeth and having a healthy smile.*





08

# TEETH THROUGH THE AGES

## BABY TEETH

Once teeth break through, it's time to start brushing. Teeth appear at around six months, and by age three, your child will have their first set of teeth – 20 'baby' teeth. It's important to look after these teeth because their baby teeth hold spaces for adult teeth and guide the adult teeth into their correct position.

Decay in the first teeth can become painful and will then affect your child's eating and development. This decay can often signal that decay will develop in adult teeth. Brushing twice a day with fluoride toothpaste, after breakfast and before bed, is the best thing you can do to prevent decay.

### BEDTIME

*Put babies to bed with a story, not a bottle. If they fall asleep with a bottle in their mouth, take it out.*



## BOTTLES & DUMMIES

Sugar in sweet drinks, fizzy drinks, fruit juice or sweetened milk can harm your child's teeth, especially at bedtime. Babies get holes in their teeth from sucking for long periods of time on bottles containing sweetened drinks or from sleeping with a bottle in their mouth. If a baby falls asleep with a bottle in their mouth, they produce less saliva to wash away the acid that causes decay. Try to use a cup for drinks rather than a bottle. Water or milk is best. Never dip your baby's dummy into anything sweet as this will almost certainly lead to tooth decay. Dummies need to be clean, free of sugary substances, safe, and never shared.

## ADULT TEETH

At around six years old, the second set of teeth starts to appear. This change continues until all the adult teeth (except the wisdom teeth) have come through at around 14 years old. As teeth develop, children need to keep up the routine of brushing twice a day and regular flossing.

### DRINK WATER

*Drink a glass of water after having a sweet drink – even after having a diet drink.*

## THE TEENAGE YEARS

Teenagers go through lots of changes – starting high school, starting work, leaving home and growing up. Oral health and looking after teeth is even more important during these years. Remember to encourage your teenager to continue with regular dental check-ups, which are free up to their 18th birthday. They should carry on brushing twice a day; the most important time to brush is at night.

## SPORT AND MOUTH GUARDS

A child should wear a mouth guard when playing sport to protect their teeth and gums. If a tooth is damaged or lost see a dental professional straight away. If a tooth is knocked out, put it back into the socket if you can. If you can't, keep the tooth moist by putting it into the child's mouth next to their cheek, or in a cup of milk. Take the tooth and the child to your dentist as quickly as possible – the dentist may be able to save your child's tooth.



# HEALTHY FOOD HEALTHY TEETH



## BREASTFEEDING

Exclusively breastfeed your baby until they are ready for and need extra food – this will be at around six months of age. When your baby is ready, introduce them to appropriate complementary foods and continue to breastfeed until they are at least one year of age.

## TEETH-FRIENDLY FOOD

Looking after teeth isn't just about brushing. The kinds of food we eat can affect acid levels in our mouths and cause decay. The more often your child eats sweet food and drinks – like lollies, cakes and biscuits, fruit juice and fizzy drinks – the more likely they are to get holes in their teeth.

If you give your child sweet foods and drinks, it is best to do so only occasionally (less than once a week) at meal times. Saliva is the body's natural defence against tooth decay – constantly replacing the minerals in teeth and washing away acids. To give saliva a chance to work, limit the number of times your child eats throughout the day. Eating three meals and two snacks each day is best. Give teeth a rest from sugar, and try to offer healthy snacks between meals.































## TEETH FRIENDLY SNACKS

BREAD  
CHEESE  
RAW VEGETABLES  
UNSWEETENED AND UNSALTED POPCORN  
NUTS  
YOGHURT

## A GLASS OF SOMETHING

Get your child to drink a glass of water after having a sweet drink. Even though diet drinks do not contain sugar, if they are acidic, like a diet cola, they can cause erosion of your child's teeth. The best drinks for your child's teeth are water and milk. Most other drinks have sugar in them, although in some drinks, the sweetness is from natural sugar, like in pure fruit juice. Save sweet drinks for mealtimes (if at all), and use a straw. Encourage your child to choose water – it's fresh and free!

## HOW MUCH SUGAR?

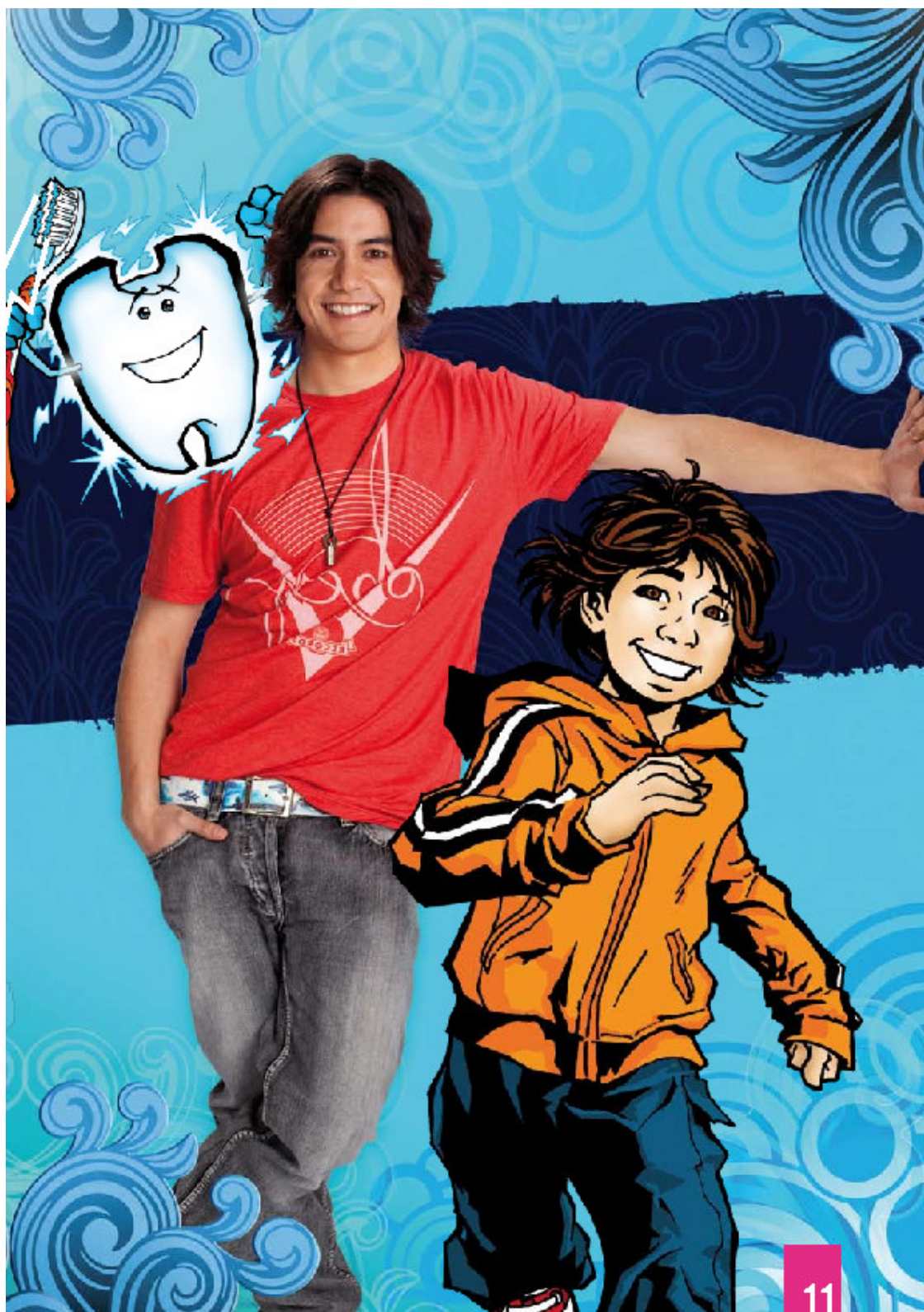
DRINK	SUGAR CONTENT
WATER	NO SUGAR
FLAVOURED WATER	2.5 TSP   
MILK	NO SUGAR
CARTON FLAVOURED MILK (1 CUP/250ML)	3 TSP   
CARTON FRUIT JUICE (1 CUP/250ML)	7 TSP      
ENERGY DRINK (1 CUP/250ML CAN)	6 1/2 TSP      
SPORTS DRINK (600ML BOTTLE)	10 TSP      
FIZZY DRINK (1 CAN/355ML)	10 TSP      











 MINISTRY OF HEALTH  
MANATŪ HAUORA



let's  
talk  
teeth

CALL  
**0800 TALK TEETH**  
(0800 825 583) [www.letstalkteeth.co.nz](http://www.letstalkteeth.co.nz)




































































[newzealand.govt.nz](http://newzealand.govt.nz)



## Appendix O



Tooth Brushing Chart for \_\_\_\_\_ (child's name) Month \_\_\_\_\_  
 For each day - scratch one square after you brush in the morning, and one after you brush at night.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
 	  Super smile!	 	 	 	  Super smile!	 Great brushing!
 Super smile!	 	 	  Super smile!	 	 	 Well done!
 	  Super smile!	 	 	  Super smile!	 	 I ♥ my teeth
 	 	 	  Super smile!	 	 	 High five! 
 	 	  Super smile!	 	  Super smile!	 	 Keep up the great work!

## Appendix P

### Snacks & Drinks for Healthy Teeth



- ✓ Fresh fruit and vegetables
- ✓ Yoghurt
- ✓ Plain crackers
- ✓ Hard boiled egg
- ✓ Plain popcorn
- ✓ Small savoury muffins
- ✓ Low fat cheese
- ✓ Pita bread with hummus dip
- ✓ Whole-grain sandwiches e.g. fish, lean meat, egg, peanut butter, cheese, marmite

### ✓ Drink water and milk



**For Babies:**

- ✓ Encourage breastfeeding
- ✓ Avoid sweet things on a dummy or in
- ✓ Remove their bottle as soon as they finish drinking
- ✓ Encourage the use of a cup rather than a bottle by age one

### Tooth Decay is Preventable



Sweet snacks and drinks can damage teeth




To reduce risk of tooth decay have these only occasionally at main meal times

**It's Easy to Protect Your Family's Smile**

Version 1, CTS 325. Developed by CCHS / CCHQ 2010

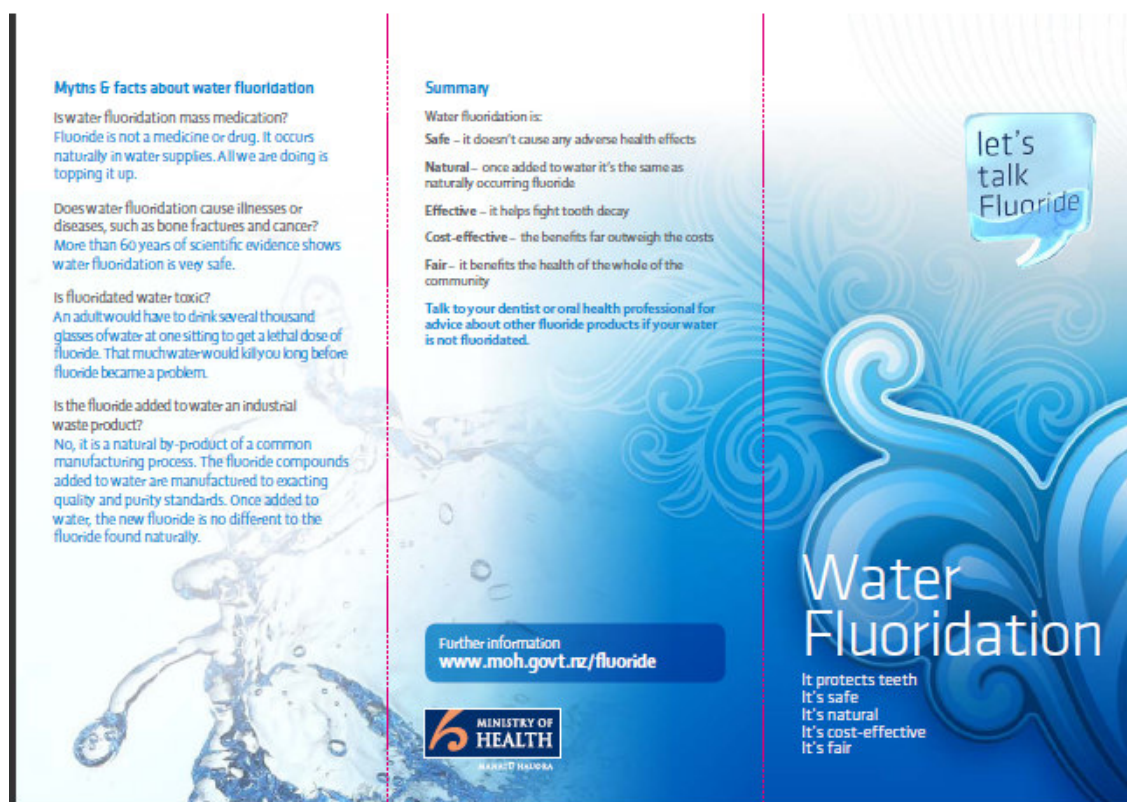
**0800 TALKTEETH (0800 825 583)**

**[www.letstalkteeth.co.nz](http://www.letstalkteeth.co.nz)**

Food and drink images © Ministry of Health, used by permission



## Appendix Q



**Myths & facts about water fluoridation**

Is water fluoridation mass medication?  
Fluoride is not a medicine or drug. It occurs naturally in water supplies. All we are doing is topping it up.

Does water fluoridation cause illnesses or diseases, such as bone fractures and cancer?  
More than 60 years of scientific evidence shows water fluoridation is very safe.

Is fluoridated water toxic?  
An adult would have to drink several thousand glasses of water at one sitting to get a lethal dose of fluoride. That much water would kill you long before fluoride became a problem.

Is the fluoride added to water an industrial waste product?  
No, it is a natural by-product of a common manufacturing process. The fluoride compounds added to water are manufactured to exacting quality and purity standards. Once added to water, the new fluoride is no different to the fluoride found naturally.

**Summary**

Water fluoridation is:

- Safe** – it doesn't cause any adverse health effects
- Natural** – once added to water it's the same as naturally occurring fluoride
- Effective** – it helps fight tooth decay
- Cost-effective** – the benefits far outweigh the costs
- Fair** – it benefits the health of the whole of the community

Talk to your dentist or oral health professional for advice about other fluoride products if your water is not fluoridated.

**let's talk Fluoride**

**Water Fluoridation**

It protects teeth  
It's safe  
It's natural  
It's cost-effective  
It's fair

Further information  
[www.moh.govt.nz/fluoride](http://www.moh.govt.nz/fluoride)

**MINISTRY OF HEALTH**  
HAKA TO HAUORA

**What is fluoride?**

Fluoride is one of the most common elements on earth. It is found in air, soil, plants, water and lots of foods.

**How does fluoride help our teeth?**

Fluoride helps to protect our teeth by making them stronger and reducing tooth decay.

**What is water fluoridation?**

New Zealand water supplies have very low levels of natural fluoride. Water fluoridation is the process of topping up the fluoride to provide protection against tooth decay.

**Is all New Zealand drinking water fluoridated?**

No. It's a decision for each council and their community. Around 60% of New Zealanders drink fluoridated water. Nationally water fluoridation has been shown to reduce tooth decay.

**Some countries choose not to fluoridate their water.**

True. Some parts of the world have high enough levels of natural fluoride in their water so they don't need to boost fluoride content. Other countries have different ways to deliver the benefits of fluoride.

**Is water fluoridation safe?**

Yes. Hundreds of peer reviewed and scientific studies over 60 years have found water fluoridation is very safe. It is supported by all the following international organisations:

World Health Organization  
British Medical Association  
British Dental Association  
Centers for Disease Control and Prevention  
US Surgeon-General  
US National Academy of Sciences  
World Dental Federation  
UK Royal College of Physicians  
Australian National Health and Medical Research Association  
New Zealand Ministry of Health  
New Zealand Dental Council  
Te Ao Marama (NZ Maori Dental Association)  
New Zealand Medical Association  
Public Health Association  
NZ Cancer Society  
Plunket

....and many more

**Does fluoride just protect growing teeth?**

No. Fluoride benefits everyone, from children to adults to older people, especially those most at risk of tooth decay.

**Water has spiritual and cultural significance to Maori. Does fluoridation support this?**

Yes. Water fluoridation can support the traditional concept of wai ora (the water of life). In fact fluoridated water brings dental health and well being by protecting the life of teeth.

**Is water fluoridation expensive?**

No. Water fluoridation is very cost-effective. The cost of adding fluoride to water is much less than the cost of fixing decaying teeth.

**Does bottled water contain fluoride?**

It depends on where the water comes from. If you are not sure, check the label.

**Do water filters take out fluoride?**

Some do, for example osmosis filters and steam distillers. Carbon filters don't remove fluoride.

# Fluoride

## Appendix R



# FREE DENTAL CARE FOR 0-17 YEAR OLDS

### Children 0 to 5 years

Are seen at a local School Dental Clinic/  
Community Dental Clinic.  
To Enrol:  
Ask your Well Child / Tamariki Ora  
provider, visit your closest dental clinic or  
call 0800 TALK TEETH

### Primary and Intermediate School Children

Will be seen at their school's dental  
clinic or in a mobile dental clinic  
visiting their school.

### Teens (up to 17 years)

Enrol with a local dentist providing the  
Free Dental Service for Teens.  
To find a dentist:  
call 0800 TALK TEETH  
[www.cdhb.govt.nz/dentalcare](http://www.cdhb.govt.nz/dentalcare)

IT'S EASY TO PROTECT  
YOUR FAMILY'S SMILE



## **Appendix S**

### **ARE YOUR TEETH CLEAN AND WHITE**

#### Tooth Brushing Song

Rhymes to improve child's awareness about oral health behaviours

(Sing this tooth song to the tune of "Do Your Ears Hang Low")

Are your teeth clean and white?

Do you brush them left and right?

Do you brush them in the morning?

Do you brush them every night?

Do you brush them up and down?

Do you brush them round and round?

Are your teeth clean and white?

Do you floss between your teeth

Removing food from places tight?

Do you floss them in the morning?

Do you floss them every night?

Do you floss them in the front?

Do you floss them in the back?

Do you floss them right?

### **BRUSH, BRUSH, BRUSH YOUR TEETH**

(Sing this tooth brushing song to the tune of "Row, Row, Row your Boat")

Brush, brush, brush your teeth

At least two times a day.

Cleaning, cleaning, cleaning, cleaning,

Fighting tooth decay.

Floss, floss, floss your teeth

Gently around your gums.

Merrily, merrily, merrily, merrily,

Flossing can be fun.

Rinse, rinse, rinse your teeth.

Keep them clean and bright.

They'll be healthy, they'll be strong

If you treat them right.

### **BRUSH, BRUSH, BRUSH YOUR TEETH**

Tooth Brushing Song - another version

(Sing this tooth brushing song to the tune of "Row, Row, Row your Boat")

Brush, brush, brush your teeth

Brush them everyday.

We put toothpaste on our brush

To help stop tooth decay.

Floss, floss, floss your teeth.

Floss them every day!

Using the string to clean between

Keeps the plaque away!

